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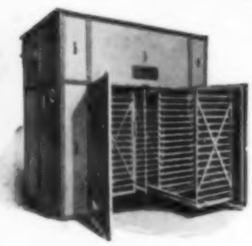

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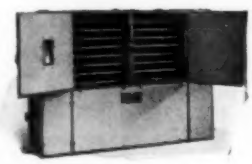

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CHEMICAL & METALLURGICAL ENGINEERING

H. C. Parmelee
Editor

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The Screaming Eagle Often Hinders Sales

THE Department of Commerce has decided that the time time is ripe for an intensive study of selling methods in Great Britain—our most important export market. A commissioner has been dispatched thither to gather information that will help the American advertiser to present his wares, by the medium of the printed word, to the British consumer, and compete successfully with the merchants of other countries.

In announcing the mission and its object, the department reminds us that "Many serious and humorous mistakes are made by American advertisers in attempting to convince British buyers of the merits of their goods." As to how far the printed word should go in supplying information as to the country of origin is a moot point. In some instances, "Where ignorance is bliss, 'tis folly to be wise"; which reminds us of an experience related by one of the speakers at the recent meeting of the American Association for the Advancement of Science, at Stanford University. An American salesman in England had concluded a depressing week's business, for which the returns were nil. After due reflection, he came to the conclusion that he might have overstressed the word "America" in designating the country of origin, so he planned an alternative method of approach. "I come from California," he introduced himself to his next prospective customer, "I wouldn't 'ave thought it," was the reply of the small-store owner. "You talk like an American."

Economical Production of Chilean Potash and Nitrate

PROSPERITY based on monopoly is usually a deterrent to scientific research; or, conversely, keen competition prompts a desire to excell. The Chilean nitrate beds produced a considerable amount of potash during and after the war, and it is interesting to note that research is again active in an effort to deliver at a cost that will permit competition with existing sources of world supply. In the April issue of *Caliche*, the official organ of the Instituto Cientifico é Industrial del Salitre, an interesting account is given of investigations recently carried out at the Mapocho oficina of the Liverpool Nitrate Co., Ltd. It has been demonstrated that maximum yield of potash is achieved during treatment of the raw material by using liquids at the highest possible density and temperature. However, the evaporation inevitable in the ordinary Shanks cachucho, or leaching vat, proved to be a serious obstacle to successful extraction. Attention was then paid to the principles underlying the modern process of hot leaching in successful practice at the duPont oficina Delaware, described in the Jan. 7 issue of *Chem. & Met.* External heating of the solutions and finer grinding of the caliche resulted satisfactorily; high densities and temperatures, with slime-free solutions, were obtainable, with insignificant evaporation, the net result being an increased extraction of potash as well as nitrate. Five different types of caliche were tested thus in 2-ton lots, with uniformly encouraging results. An interesting development was the saving in fuel needed, as compared with Shanks-maquina practice, estimated at 25 per cent. Furthermore, owing to the more efficient displacement of solutions, the amount of water needed was so much less that with caliche of 20-per cent grade no external evaporation was necessary.

These researches are continuing, and further figures confirming the results obtained at Oficina Delaware will be awaited with interest. As one of the leading chemical industries of the Americas, Chilean nitrate production cannot remain indefinitely divorced from the benefits of research and impartial scientific investigation.

Again, the Secret Of Ancient Egypt

WE HAVE had a number of inquiries regarding the authenticity or source of a story that has been given wide publicity in the press during the past few weeks. The item with its most ornamental frills removed ran usually like this:

> The secret of hardening copper, lost 2,000 years ago with the passing of ancient Egyptian civilization, has been found accidentally by a railway switchman with an eighth grade education. The switchman, James Earl Cummings, 33, with a wife and six children between the ages of 1 and 10 years, today has a check for $1,500,000 paid him outright for his discovery by a big copper company in Detroit. He was broke a week ago.
>
> He was cleaning the copper gaskets of his automobile, a low-priced car of disreputable appearance, when he stuck them into a mixture which he "figured would clean them best." The gaskets, he discovered, would spring back to their bent form when he tried to straighten them.
>
> He told some of the boys at the shop about it, and they said his fortune was made. He patented the device, demonstrated it before officials of the large Detroit company and received a check for $1,500,000.

It is surprising how many readers give credence to such a fable without stopping to weigh the probable monetary value of such a process, if there were such a process. To the ancients even the comparatively slight hardening obtained by cold work or the addition of alloying metals was of great importance, but in these days of alloy steels a method of making copper really hard would have only a limited commercial value on account of the high cost of the metal.

If in addition to giving copper hardness and great strength our switchman succeeded in doing a few other things, such as retaining the high electrical conductivity, we should obtain a new material of great utility. Up to the time of going to press, however, this has been done only in the imagination of the imaginative.

A Sure Road To Overproduction

NO ONE would experience great surprise if an executive were to say: "Before we go ahead with this plant, let us find out about the market for the product." In fact, it would be somewhat amazing if the executive did not say it. It sounds like rather elementary common sense.

With this in mind, it is interesting to look through what we might call the chemical morgue of recent years. Numerous products are to be found there with interesting histories. There is one type of history that is especially interesting in connection with the subject of the editorial. It would run like this. The Blank Co. began the manufacture of *X* after completing its plant. The product came on the market shortly and was of good quality. The company seemed to experience difficulty in selling, which it overcame by a cut in price. The relief was temporary, however, for its price cut was met by other producers. After 2 or 3 years of unprofitable effort the product was discontinued.

The histories of several cases known in greater detail reveal no lack of study of marketing conditions or of the extent of the market. Complete data had been obtained as to the annual consumption, the specifications and the kind of packaging desired. But a completely erroneous interpretation of these data had been made. The companies were apparently lured into the manufacture of a commodity because there was a big market for it. In many cases they actually built plants that were large enough to supply the whole demand for the product—100 per cent of it. They failed to consider the producing capacity of the country, and the inevitable result was a crowded market, overproduction, cost cutting and eventual disgust with the new product.

If this experience had fallen to the lot of a novice, it might be a cause for condescension or a deprecatory gesture. But when it happens to leading companies in the chemical engineering industries, it is time to call attention to the underlying principle and to urge the sound interpretation of fundamental data of marketing.

Ammonia Liquor Market Disappearing

WELL-INFORMED builders of coke-oven and gas-works equipment are convinced that gas and coke producers who have been accustomed to market their ammonia in the form of liquor must very soon take account of the rapidly decreasing demand for ammonia in this form. There are several plants, either built or building, making ammonia by synthetic processes, and these plants will market liquid ammonia, which will then replace an equal amount of the ammonia previously made from gas-works liquor. It is expected that two more of these plants will be operating within the next few months, each supplying several tons daily of liquid ammonia, with the result of a corresponding decrease in liquor demand.

The synthetic air ammonia industry is just beginning in the United States. It may not be long until the entire liquid ammonia market can readily be supplied from this source. Hence it will be a very important problem for the coal-gas manager to determine what he is going to do with his byproduct ammonia when such time comes. High cost of synthetic ammonia for the present prevents the rapid extension of these plants; but it is none too soon to study a problem that is sure to become serious within a few years and in some parts of the country, at least, to reach serious proportions.

One of the most obvious remedies is to make ammonium sulphate instead of ammonia liquor, for the synthetic plants will probably not successfully compete in this field for some time. One large company, which recently contracted for a gas-oven plant originally planning to make liquor, reasoned thus and has changed its plans to make ammonium sulphate instead. Several new small oven plants also are to be equipped for production of sulphate instead of liquor. Other large coal-gas works probably will do likewise, not only for new plants but for those already operating. A small coal-gas works, on the other hand, usually cannot make ammonium sulphate with financial advantage. Hence these plants will have to look for other methods of successfully meeting this industrial development, perhaps by conversion of liquor to sulphate at some large nearby works. In every case, however, the problem is likely to become one of concern to the manager who at present is marketing any ammonia in the form of liquor. The steps already taken by one or two oven owners are sure evidence that the question is expected to be of more than academic interest.

To Expedite Procedure In the Patent Office

THE United States Patent Office has issued one and one-half million patents and today is confronted with the responsibility of more frequent patent issue than ever before in history. It took fifty-seven years for the first half million patents to come to issue; the second half million were issued in eighteen years; the third half million within thirteen years; and at the present rate the fourth half million will appear in very much less time than this. This shows how striking a development has been made since the patent system was first established when the President of the United States personally granted each patent, signed the document, with countersignature by the Secretary of State, and the Attorney General.

The present Commissioner of Patents refuses to allow this pressure of business go on without bringing to bear upon the problem the very best minds available. He and the Secretary of the Interior have taken steps to form a committee of representatives of the American Bar Association and of some of the leading patent bar organizations. This committee is being asked to aid in the simplification of Patent Office procedure and the expediting of Patent Office business. There is no doubt that this co-operation will be very beneficial to government and public alike. Patent procedure is intensely technical and involves highly specialized branches of the law. Even the best in the business are none too skilled to advise regarding this very essential governmental activity. Industry as well as the legal profession will, therefore, be delighted at this new plan and will wish the committee the greatest of success in its work of co-operation with the public officials.

England Five Years After the Peace

Some First-Hand Observations of the Economic and Social Status of the British Nation and People

By E. J. Mehren
Vice-President, McGraw-Hill Co.

THE WAR is past history in America, but current history in Great Britain.

So, indeed, it seems after spending a week in Britain's capital, conversing with her men of affairs and listening to addresses by her business leaders and statesmen. True, there are war scars in the United States, scars that will never be erased. We are mindful of the men who died in the great struggle; we have great numbers of disabled veterans. On the financial side we still have, and will have for many years, a war-swollen budget and correspondingly increased income taxes. But, by and large, the war shadow has thinned out. In the last two years we have had "good times." Our war-time income tax rates have been twice reduced. Certainly the way is not blocked by serious obstacles. The difficulties we foresee are merely the fluctuations which, except for the "panic years," one might say are normal to business.

Not so with Britain. The war is only a yesterday with her, and the consequences are still sharp upon her. I do not mean that she is discouraged; that word has no place in the British vocabulary, nor has the state of mind it indicates any place in British consciousness. But the burdens that weigh her, the obstacles still to be overcome, are fully appreciated and are a stock subject of discussion with all her thinking men.

To enumerate some of the troubling factors:

There is still large unemployment—though the amount is lessening.

There is marked depression in the "engineering trades," as they are called here—shipbuilding, machine tool building, and the metal fabricating industries generally. In construction there are few large projects in hand, though there are a few that, after long delay, now seem likely to be taken in hand.

A new housing bill, that will again dip heavily into the national and into local government treasuries—and increase, accordingly, national and local tax burdens —is before Parliament.

The income tax rate on even small incomes is 4 shillings 6 pence per pound sterling, or 22½ per cent. The super-taxes are very heavy.

The Continental problem is acute and the consequent uncertainty, the upset exchanges, the diminished purchasing power, curtail British export markets.

Finally, the never-ending exchange of views with their Continental war Allies on German reparations, keeps before the British people constantly the fact that peace, though declared five years ago, is not yet here. There is cessation of military activity; there is not that accord which is peace in actuality.

That the consciousness of the international element in these difficulties is ever present with the thinking Britisher was strikingly demonstrated at the great advertising convention held here, at the British Empire Exhibition, last week. There were delegates from every country, though the United States sent the largest representation, 1,700 (including the ladies). To this great convention, man after man emphasized the distressed position of Europe and expressed the hope that out of the international discussions now under way in London, and participated in by the United States, there may come that peaceful adjustment for which Europe has been longing since that wonderful Nov. 11, 1918.

In private conversation one gets an even more serious picture of England's difficulties, for there the talk turns to social conditions. Briefly, the burden of these conversations can be reduced to just this: that the altruistic promises of war times and the coddling of politicians have taken from the mass of British workers a sense of responsibility for their own welfare and led them to expect the government to take care of them. Thrice, indeed, was the statement made to me, and in separate conversations, that there was a growing opinion, fostered by socialist agitators and politicians, that if the people would have the babies the government would do all else.

The worst of the difficulty is that no one with whom I have spoken about this attitude of the people seems to have any hope for early improvement. The politician—not the statesman—is the ruler of the day, and, as with us, he does not hesitate to sell the public treasury in order to advance his personal interests.

Withal, though, it should be repeated, that the Englishman is not discouraged. He has lived through a lot. He hopes that he will live through this trying period, and that a better day will come.

His way is not our way. We would think that his more or less complacent attitude might be fatal. He believes that the situation will turn out all right; we would fear that it would turn out all wrong unless vigorously handled. (One recalls our Unemployment Conference of some years ago.) We, I hope, would turn, so long as possible, to private measures of relief. The British have turned to the Government. The difficulties, of course, were very great; the amount of unemployment, for example, quite large. Possibly with similar conditions we would have been forced to a similar solution, but I am inclined to believe that the British tap the national treasury with less hesitation than we. The actual war, let us recall in possible explanation, lasted twice as long for them as for us.

But though our methods might differ from those of the British we cannot withhold our admiration of their sterling qualities. Similar conditions would put us in a panicky condition. They go on hanging out their sign "business as usual," confident that eventually all will be well.

Looking back on their long and brilliant history, we, too, can feel confident that somehow the Briton will come out on top. Trial and difficulty develop stamina and character. They are developing them right now in business circles. In the wage earning classes the tendency is in the opposite direction. Eventually, under the example of conscientious leaders, even that tide should change.

Chemical Engineering in Industry

A Review of the Development of the Profession, an Estimate of Its Present Status and Its Responsibilities and an Extrapolation to the Future

By H. C. Parmelee
Editor, *Chemical & Metallurgical Engineering*

A LARGE part of an editor's business is to induce people to think. He is employed partly for that purpose and is supposed to do some thinking on his own account. It is his duty to observe the trend of things, exercise foresight in the selection of his topics and skill in their presentation. Nevertheless he may occasionally suffer from mental myopia, due to a habit of examining things intimately and at too close range. As a consequence he may occasionally get a distorted image, and what he needs then is to correct his vision by putting the concave lens of great distance between himself and his job. He also needs to learn by the process of friction between his own and other intellects. But if it is a part of my business to induce people to think, it does not necessarily follow that my ideas are always right. Occasionally I have induced large numbers of people to disagree with me.

> Ideas about chemical engineering and the function of the chemical engineer in industry have become crystallized in recent years. The need for a man with both the broad and specific training given by the better courses of instruction in chemical engineering has been demonstrated. The future of the profession is bright with infinite possibility of rejuvenating antiquated industrial practice, of creating new production methods, of making the world a better place because of cheaper necessities and of new luxuries.

For some years I have been an advocate of chemical engineering and the chemical engineer, as distinguished from chemistry and the chemist. And while I am not here to proselyte or convert you to my point of view or to any particular school of thought, I do want to induce a little thinking about chemical engineering in industry and the far-reaching influence of technology on our industrial production. All branches of science applied to industry are having a profound effect on our social order and scale of living. New wants are created, stimulated and satisfied almost over night, and the novelty of yesterday becomes the commonplace necessity of today. In this industrial transformation chemical engineering is playing a part sometimes spectacular and always important.

I am aware of the fact that there are those who stoutly contend that there is no such thing as a chemical engineer. Their conservative faith in the chemist leads them to regard the chemical engineer as a sort of modernist, a heretic who has been lured from the strait and narrow path of chemistry by the glittering attraction of the word "engineer." These conservatives prefer the titles "industrial chemist" and "engineering chemist," although they are agreed on the nature of the job to be done. In this respect they are like those politicians who strain at the League of Nations but would readily swallow an association of nations or any other similar organization with a different name. Still others seem to think that a few chemists have added the title of engineer without any special reason.

I am only too well aware of the abuse to which the term engineer has been subjected by all kinds of people who have appropriated it for the purpose of adding dignity and prestige to their jobs. One of my associates on *Engineering News-Record* has made an interesting collection of the varieties of engineers and has identified and located no fewer than 105. The list makes excellent light reading. We find the adhesive engineer, who is probably a bill poster; the body engineer, who may be a gymnasium instructor; the correspondence engineer, who doubtless writes form letters; the clothing engineer, who is an aspiring tailor; the exterminating engineer, who will rid your house of pests; the hot dog engineer, who vends the tasty delicacy that made Coney Island famous; the psychic engineer, who will read your past and predict your future; the second story engineer, who probably does not realize that the public will look upon him as a glorified burglar; the shoe surface engineer, who is an exalted bootblack; the turf engineer, who will make a lawn or lay out a golf links; and the wrecking engineer, which would be an excellent title for certain promoters of questionable processes. Still more imaginative and suggestive are the hymn book engineer, the forgery engineer, the life-saving engineer and the mosquito engineer. California has made its own contribution to the list in the person of a dwelling engineer at Sacramento and a dehydration engineer, who presumably is an expert in fruit drying. In the interest of efficiency and economy I think that many of these 105 should form partnerships, and I should be inclined to back a combination of the hymn book engineer and the life-saving engineer.

But I submit that the chemical engineer is not be looked upon as No. 106 in this list of aspiring individuals who, possessing none of the qualifications or attributes of the engineer, have sought to elevate their jobs or increase their importance by appropriating the title. The chemical engineer is a product of our industrial development. True, he is a comparatively recent

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An address delivered before the Southern California Section of the American Chemical Society at Los Angeles, June 27, 1924; and the California Sections of the American Chemical, and the American Electrochemical Society at San Francisco, July 2, 1924.

product. You will not find him even mentioned in the literature of 20 years ago, although his prototype then began to take form in the minds of a few individuals who realized the need of his existence. It was not until 1907 that more or less nebulous ideas about chemical engineers and chemical engineering began to take form. And if you will read the history of the organization of the American Institute of Chemical Engineers you will see that even at that time the conception of that branch of engineering was still hazy in the minds of those who today are its leaders. There was an impression, however, that those who were engaged in industrial operation needed more than chemistry supplemented by a little knowledge of mechanical engineering. They were even then impressed with a fact that is still more patent today—namely, that the mechanical methods of applying chemical processes efficiently and economically are always as important as sound chemistry, and frequently more vital to the success of the industry. And so, as late as 1907, we find chemical engineering little more than a strong conviction in the minds of a few leaders who foresaw the need of training a new type of man for a new kind of industrial job.

Obviously one of the first obstacles in the way of developing the new type of engineer of which industry had recognized the need was the lack of suitable educational facilities. If the chemical engineer was a more or less hazy concept, chemical engineering education was still more nebulous. There was no harmony of opinion, no unity of thought, no crystallization of ideas on this subject. One of the first committees of the American Institute of Chemical Engineers was on education, and its early records show the most diverse views. There were, however, a few who adhered to certain basic principles that have been accepted and taken form in later years. Based on the best opinion of the time, courses were organized in some schools. But it was not long before the desire to offer courses in chemical engineering spread like a fad over the whole country, with the result that practically every institution of note and many of minor importance cataloged a course in that subject. For the most part these were hybrids of chemistry and mechanical engineering with no adequate conception of the type of man to be produced nor of the necessary co-ordination of studies to produce him. This condition has persisted even to the present day in spite of the progress that has been made and the clearer perception that has been gained as years have passed. From my personal knowledge some courses in chemical engineering have not been altered since they were first cataloged 15 years ago, and they were weak and immature then.

On this historical background, I should now like to sketch the present status of chemcial engineering and the chemical engineer, outline the chemical engineering industries and show the firm foundation on which the whole structure has been reared. The vital factor in the ground thus far gained, and one not to be overlooked in accounting for the progress of chemical engineering, is the close co-operation that has existed between the industrial and educational forces. Industry has defined its need and education has tried to supply the demand. By working in close harmony through joint committees both groups have learned to speak the same language, with the result that there is a clear-cut understanding among the leaders on both sides of what chemical engineering is, what a chemical engineer should be, and, most important, where he is to fit into industry.

The details can be elaborated from the following definition. Chemical engineering is not a composite of chemistry and mechanical and civil engineering, but is itself a branch of engineering, the basis of which is those unit operations which in their proper sequence and co-ordination constitute a process as conducted on an industrial scale.

The Unit Processes of Chemical Engineering

What are these so-called unit operations that form the basis for a distinct branch of engineering? I have from time to time extended the list until it comprises fifty or more, but a selection of the more common ones will illustrate the point. Such operations as agitation, classification, crushing and grinding, distillation, drying, evaporation, filtration, refrigeration and thickening are obviously not the subject matter of chemistry as such, nor mechanical engineering, and yet they are used in a large number of apparently diverse industries. There is another group including absorption and adsorption, crystallization, flow of gases, transfer of heat and sublimation that are more in the domain of physics than of chemistry. A third group covers those operations of nitration, fermentation, saponification, etc., in which a chemical change is accomplished. The treatment of all of these unit operations in a quantitative way based on the laws controlling them, and the equipment by which they are carried out, is the province of chemical engineering as it is conceived today. The field is differentiated from chemistry as a science and even from industrial chemistry, the latter being concerned primarily with the chemical reactions involved in processes and products. A further and most important difference to be emphasized is that chemical engineering concerns itself with efficient and economical production and the making of a profit. In the same sense that good metallurgy consists in making money out of ore, so chemical engineering consists in profitable production of a variety of useful commodities. It has little or no academic, cultural or artistic value. It is dedicated wholly to industrial production.

The Chemical Engineering Industries

The industries that come within the realm of chemical engineering are not so clearly defined as are the unit operations. An ideal list could be extended indefinitely on the assumption that there is a scientific basis for almost every industry, but practically we very quickly approach a border line between industries that are logically chemical engineering in the nature of their processes and products and those in which the chemical engineer has not yet been recognized as an important factor. As the list is extended the connection becomes more tenuous until it is finally lost in those industries in which production is wholly on an empirical basis and controlled by rule of thumb. I have suggested this condition in the following grouping of some of the chemical engineering industries, with the reservation that any system of grouping must be regarded as somewhat arbitrary and subject to criticism and debate.

Group I	*Group II*	*Group III*
Heavy Chemicals	Sugar	Food Products
Fine Chemicals	Paper	Ceramics
Explosives	Petroleum	Leather
Dyes	Rubber	Paint and Varnish
Coal Byproducts	Cement and Lime	
Wood Byproducts	Soap	
Electrochemicals	Fertilizer	

In the first group are those industries that are essen-

tially chemical in character of process and product. Their scientific basis is recognized within the industries themselves, and for the most part they are directed and controlled by technically trained men. This does not imply, however, that they have become standardized beyond improvement or that opportunity no longer exists for economies in production. In fact, the technology of these industries is in a constant state of flux as a result of research and investigation, so that over a period of several years revolutionary changes may be made.

In the second group are industries that give no hint or suggestion of chemistry or chemical engineering, and yet both are involved in varying degree in producing commodities of daily use. Some of these industries are as old as recorded history and their products have been known for generations. The highly specialized technology that characterizes them today has been developed only within the last decade or two. But if we examine the processes carefully in the light of our definition of chemical engineering we shall find that these industries are logically included in the scope of the subject. It is recognized that not every plant in these industries is on a scientific basis, nor can it be said that these industries have looked upon themselves as chemical engineering in character. And yet technology has penetrated them so deeply and has influenced production so profoundly that the plant which is on a strictly empirical or rule-of-thumb basis is the exception and usually of small significance. While some of these industries may be regarded as on the border line, it will not be long before they will be recognized as wholly within the field of chemical engineering.

So broad a statement can scarcely be made with respect to the industries in the third group. This is due largely to the fact that in the course of generations they have reached a high state of development as arts rather than as technical industries. Science and engineering have as yet made few contributions to these processes or products when compared with the results that have been obtained by empirical methods alone. And yet in each of these industries there are some outstanding and conspicuous successes where chemical engineering has played the dominant rôle. These are the exception, however, and it is likely that technical methods of control and operation will not soon supersede rule of thumb.

The Surprising Similarity Between the Production of Artificial Silk and of Paper

By way of illustrating the relation between these apparently diverse industries and showing their common bond in the use of certain unit operations, we may compare the manufacture of paper with the production of artificial silk, taking the latter as an example of cellulose products that are included in the fine chemical industry. In the manufacture of paper from pulp, the principal unit operations are disintegration of the raw material, digestion, washing and bleaching, screening to remove large particles of unpulped wood, filtration of the pulp, mixing with size or filler in the beating machine, forming the sheet and drying it. In the production of artificial silk by the cuprammonium process we have an almost parallel line of unit operations: Disintegration of the cotton by shredding, digesting, bleaching and washing for the purpose of purifying the cellulose, mixing the fine cellulose with the cuprammonium solution, screening and filtering to remove clots of undissolved cellulose, spinning the thread and finally washing and drying it. The parallelism of the processes when expressed in terms of unit operations is in striking contrast to the difference in the products. Both industries are in the field of chemical engineering, and a man trained in the fundamental principles could readily adapt himself to production in either industry. Similar parallels might be drawn between other industries in the list.

Taking the group as a whole it scarcely requires proof that chemical engineering has been responsible for cutting costs, increasing production and improving the quality of the products in these industries. In addition there have been spectacular developments that are directly attributable to chemical engineering. The great variety of cellulose products has had a profound economical influence and will still further affect commerce and trade. Coated fabrics have displaced leather, pyroxylin plastics have superseded ivory, nitrocellulose lacquers give promise of being the best auto enamels we have yet known and artificial silk has made a place for itself in the textile world. Add to these developments our dye industry, the manufacture of synthetic resins and the cracking of petroleum and we have a list of important achievements that can be ascribed largely to chemical engineering.

Educating the Chemical Engineer

I have already suggested how important a part chemical engineering education is playing in the development of these industries. For the progress that has been made in formulating satisfactory courses of study a great deal of credit must be given to the eminent educators and industrialists who have been on successive committees of the American Institute of Chemical Engineers for the past 15 years. The work of this organization has proceeded so far that its present committee on chemical engineering education has been directed to make a survey of colleges and universities in the United States and select for the Institute's approval those schools which, in the opinion of the committee, are giving satisfactory courses. This procedure is in harmony with the practice of the American Bar Association, which has for some years past classified law schools in accordance with certain educational standards. While no list of approved schools in chemical engineering has yet been published, it is felt that the movement will have a beneficial effect in raising the standards of chemical engineering training. No attempt will be made to force the adoption of a standardized course. On the other hand, the approval of the Institute will not be gained unless in the opinion of the committee a school has the personnel and equipment for giving a student the necessary broad foundation of culture in English and economics, a fundamental training in mathematics, physics and chemistry, a thorough course in chemical engineering and minor courses in related branches of engineering and science.

According to a survey I made last month, about one thousand young men will graduate from chemical engineering courses this year and practically all of them will be absorbed in industrial plants. This means that our technical schools today must shoulder a heavy burden of responsibility for rapid industrial progress. Improved processes, cheaper production, elimination of waste, substitution of science for rule of thumb, and all the other concomitants of industrial progress have long

since become the function and the sure result of applied science and engineering. And since technical training is prerequisite to these accomplishments, the opportunity as well as the responsibility of the technical school is obvious. Good operators and production men will continue to come up from the ranks of industry, but the great fruits of research and development must come from technically trained men. Henceforth industrial progress will be made by the technologist and not by the so-called practical man, however well the latter may know the details of his job.

Personnel More Important Than Curriculum

The degree in which the colleges meet this obligation will depend not so much on curricula and laboratories as on the personnel of their faculties. Success will be measured not so much by the label that is put on a course of study as by the philosophy underlying its conception and method of presentation. For chemical engineering is not yet so firmly rooted in all our colleges that it is clearly distinguished from a nondescript collection of courses in industrial chemistry and mechanical engineering. And it is in precisely the degree in which this distinction is perceived and executed that the college will gain recognition for itself and its students in chemical engineering.

In addition to giving undergraduate courses, another opportunity for service on the part of the technical school lies in carrying graduate chemical engineering directly to the industry. A plan already in effect at the University of Wisconsin can be adopted by similar institutions located in or near important industrial centers. Briefly, the Wisconsin plan provides graduate instruction for a limited number of engineers already engaged in commercial work in Milwaukee. A 3-hour seminar is held every Friday evening and on the following day the instructor visits the different plants in order to discuss with the individual students the progress and problems of their research projects. The subjects investigated deal with industrial problems of practical importance to the employing firms. This, of course, is one of the reasons why the industries have been more than willing to provide financial support for the course and to give their time and facilities for carrying forward the research and study. The advantages accruing to the individuals who thus see and use the direct application of science in solving everyday problems of production are too apparent for further comment. The university is also greatly benefited by an arrangement that brings its instructors into intimate contact with both the scientific and practical demands of the industries.

I see no reason why a similar plan could not be carried out in this city to the great advantage of you who are engaged in industrial work, your employers and the school that may undertake the work of instruction.

In closing this brief survey of chemical engineering in industry and the factors that are contributing to its progress, I want to leave with you a picture of the magnitude of the chemical engineering industries and their importance to the State of California. In the table that I have prepared from the Industrial Census of 1919 (the latest available) I have given certain data on twelve industries for the United States and for California and have indicated the rank of the latter among the producing states. It is obvious from a study of the figures that owing to its isolation from the industrial centers of the East, California is in a large sense a self-contained and self-supporting commonwealth. In most of the industries listed it ranks near the top in number of establishments, number of wage earners, value of the products and value added by manufacture.

I call your attention particularly to California's rank in the last two items—namely, value of product and value added by manufacture. You will notice in the

Magnitude of Chemical Engineering Industries

Industries		No. of Plants	Wage Earners	Value of Product	Value Added by Mfg.	Capital	Wages	Primary Hp.
Chemicals	U.S.	598	55,586	$438,659	$222,368	$484,488	$72,848	376,900
	Calif.	49	1,466	10,539	4,409	....	....	....
	Rank	4	9	10	11	....	....	....
Explosives	U.S.	118	9,249	92,475	46,564	133,248	12,505	51,600
	Calif.	3	611	6,408	3,555	....	....	....
	Rank	7	3	4	4	....	....	....
Beet sugar	U.S.	85	11,781	149,156	62,127	224,585	15,908	127,400
	Calif.	10	1,512	26,354	12,200	....	....	....
	Rank	4	4	3	2	....	....	....
Paper and pulp	U.S.	729	113,759	788,059	320,577	905,795	135,691	1,851,000
	Calif.	7	806	5,805	2,398	....	....	....
	Rank	20	21	20	20	....	....	....
Petroleum refining	U.S.	320	58,889	1,632,533	348,624	1,170,278	89,750	238,900
	Calif.	45	5,132	213,292	71,416	....	....	....
	Rank	3	4	3	1	....	....	....
Rubber	U.S.	477	158,549	1,138,216	543,872	960,071	193,763	429,900
	Calif.	22	736	6,295	3,393	....	....	....
	Rank	7	14	13	12	....	....	....
Cement	U.S.	123	25,524	175,265	95,755	271,269	42,691	488,800
	Calif.	8	1,316	11,258	7,144	....	....	....
	Rank	4	6	4	3	....	....	....
Lime	U.S.	476	11,405	33,970	19,674	45,845	10,869	51,700
	Calif.	8	159	564	283	....	....	....
	Rank	15	20	18	19	....	....	....
Soap	U.S.	348	20,436	316,740	78,221	212,417	21,228	33,700
	Calif.	27	608	11,295	2,983	....	....	....
	Rank	6	10	8	9	....	....	....
Fertilizer	U.S.	600	26,296	281,144	96,103	311,633	25,363	125,900
	Calif.	17	284	3,610	1,077	....	....	....
	Rank	13	19	19	17	....	....	....
Leather	U.S.	680	72,476	928,592	282,070	671,342	88,205	218,200
	Calif.	21	1,453	21,416	4,945	....	....	....
	Rank	9	12	12	11	....	....	....
Paint and varnish	U.S.	830	21,507	340,347	123,234	239,776	24,118	85,200
	Calif.	46	737	11,846	4,164	....	....	....
	Rank	6	8	8	8	....	....	....
Total, 12 industries	U.S.	5,384	585,457	$6,315,156	$2,239,179	$5,630,747	$732,939	4,079,200
	Calif.	263	14,820	328,682	117,967	....	....	....

Compiled from the census of 1919. All money values expressed in thousands. Although this table was compiled with special reference to California, similar studies can be made for any state and its important industries. The figures are the latest availab'e for uniform comparison throughout the industries, state and nation.

case of petroleum, for example, that in value of product the state ranks third, whereas in value added by manufacture it ranks first. A similar condition exists in the case of beet sugar, rubber, cement, fertilizer and leather, in each of which the rank is higher in value added by manufacture than it is in value of product. If I interpret these figures rightly, they mean that in those industries for which California has an adequate supply of raw material and power, combined with a large consuming market and freedom from strong competition, there is an exceptional opportunity for making a profit in industrial operations. Other interesting information can be gained from a study of these and other industrial statistics with respect to the possibility of extending chemical engineering industries in this state. Those industries that are heavy consumers of power, such as paper, cement and rubber, would be particularly desirable provided the other economic factors of raw materials and market are also favorable.

Finally, I should like to direct your attention to the moral aspect of these great industries and to the necessity of safeguarding their integrity. They are at the very foundation of our industrial structure and their products influence the daily life of every citizen. To shield them from the unscrupulous promoter is one of the first duties of technical men. I have often pondered the essential honesty of chemists and engineers, and their consequent value as good citizens, and have attributed it to the fact that they deal with fundamental truths, exact mathematical relationships and the fixed and immutable laws of nature. Men in other callings may adopt makeshifts and expedients, but technical men cannot trifle with truth and long remain in business. Lawyers may engage in a battle of wits to serve their clients, but engineers can deal only with facts and figures. The relation of a circle to its diameter is still 3.14159 in spite of the proposal of an optimistic Southern legislator to abolish the awkward decimal and make it an even 3.

Fakers Should Be Exposed

But if the technical industries are fundamentally important to a community, they are also attractive to the faker, the charlatan and the half-baked scientist, because it is possible to paint the prospect in such glowing colors, and to make such a spectacular appeal that the public parts only too readily with its hard-earned money. It devolves upon all of us to expose these swindles and to keep the public well informed of their operations. One section of the American Chemical Society has a standing committee on fakes and fakers and it has rendered valuable service to its community. It has been estimated by various authorities that from one-half to one billion dollars is taken annually from the American people by swindling promoters. The National Vigilance Committee of the Associated Advertising Clubs succeeded in putting out of business in 1920 fake companies that had already swindled the public out of one-quarter of a billion dollars. In the State of Texas alone companies capitalized at one hundred million dollars were put out of business only after about fifty million dollars of their worthless stock has been sold. Not the least unfortunate part of this condition is the loss of confidence by investors in legitimate ventures of a technical and engineering character.

If in the course of my remarks I seem to have placed too strong an emphasis on chemical engineers and chemical engineering as compared with chemists and chemistry, I want to assure you that there is no disparagement of the latter nor any attempt to minimize their importance. They could well be made the subject of more dramatic treatment than I would be able to give them. There is no thought of exalting the one above the other, because all are essential to the development of American industry. As I said in the beginning, my whole purpose was to induce a little thinking about chemical engineering and the industries that come within its scope. I believe that the subject is of vast importance to the efficient and profitable development of California's industries and consequently worth some of your time and attention.

California's Industries Still Young

For the most part your industries are in their infancy and the time to put them on a scientific basis is while they are still young and amenable to wise counsel. It happens all too frequently in a new country with vast resources that the need of economy and efficiency are lost to sight. My appeal to you is to preach among your business friends and acquaintances and to the public of California the doctrine of science applied to industry, and to do it before it is forced upon you by prodigal waste of natural resources or competition with other communities. California has a wonderful heritage which will be developed to the fullest extent only by technically trained men. But it will require vision and enthusiasm on your part. It has not been many years since this coastal region was regarded as a liability rather than an asset to the United States, and one of our greatest statesmen debated against the acquisition of this very territory. Speaking in the Senate in 1844 Daniel Webster said:

"What do we want of the vast worthless area, this region of savages and wild beasts, of deserts of shifting sands and whirlwinds of dust, of cactus and prairie dogs? To what use could we ever hope to put these deserts or these endless mountain ranges, impenetrable and covered to their base with eternal snow? What can we ever hope to do with the western coast of 3,000 miles, rockbound, cheerless, uninviting, with not a harbor in it? What use have we for such a country? Mr. President, I will never vote one cent from the public treasury to place the Pacific coast one inch nearer Boston than it is today."

This was fine oratory, but poor prophecy!

The question is whether we can see any farther ahead now than Webster could in 1844. I believe that we can. And it is to aid in that process that I have tried to sketch for you the development of chemical engineering, the education of the chemical engineer and his place in the chemical engineering industries.

Production of Thymol and Menthol in Australia

Two Sydney technologists have recently developed a process by means of which they are able to produce thymol on a commercial scale. The raw material used is Australian eucalyptus oil. The Director of the Institute of Science and Industry states that samples of the thymol have been submitted to various authorities, who agree that it reaches all the standards required by the British Pharmacopoeia. Stocks of material will shortly be put on the market. By means of another process, the same experimenters have been able to manufacture menthol from another Australian product. This is considered important, as previously the bulk of the world's supplies of menthol has come from Japan.

A Peculiar Dust Explosion

Investigation of the Causes and Possible Origin of a Dust Explosion in a Spray Drier Used on Milk

By William A. Noel
Associate Development Engineer, Bureau of Chemistry, U. S. Department of Agriculture

AN UNUSUAL explosion occurred in a milk drying plant in Valders, Wis., on the night of Oct. 1, 1923, severely injuring one man and damaging the property to the extent of $25,000. A preliminary investigation of the explosion was made by the Industrial Commission of Wisconsin and a later investigation was conducted jointly by the Office of Development Work, Bureau of Chemistry, United States Department of Agriculture, and the Industrial Commission.

Story of the Explosion

About 11:30 o'clock at night the operator in charge of the plant noticed a bright light in the drying chamber reflected through the glass-covered peephole. He opened the door, looked in and saw what appeared to be a handful or two of burning milk powder on the side of the hopper (A in Fig. 1). He called the night watchman to come to his aid and ran to the boiler room for a fire extinguisher. On his return from the boiler room, he shut off the air fan and turned on the motor connected to the screens and shook down the dust arrested by them. At the same time he drew off the powder collected in the hoppered bottom of the drier, which amounted to about $\frac{1}{2}$ to $\frac{3}{4}$ bbl. His thought in doing this was to remove the milk powder before operating the fire extinguisher in the drier, since operation of it would spoil the powder. Just a short time before a considerable quantity of powder had been drawn off. During this time, which was about 5 minutes after the operator first saw the fire in the drier, the watchman was standing on the second floor looking through the door on the side of the drier. He said, "The fire appeared to be dying out, when all of a sudden 'Bang!' it went," and he was blown back through the room about 25 ft. The roof went up and came down on him, the sides of the building were blown out, and the operator, who had started up the stairs, was blown back down and out through an exit door. Fire immediately followed. The detonation was not very loud nor was the effect of the explosion felt for any distance.

At the time of the disaster only two men, an operator and a watchman, were on duty in the drying plant. Both of these were in the path followed by the high-pressure air currents sent out from the center of the disturbance, but they were uninjured by percussion. The watchman was burned by the first flash and his clothing was set on fire. He made his way, a considerable distance, to a tank of water and crawled into it to extinguish the burning clothing on his body, after which he got out of the building through a window and jumped down to the roof of a lower building, from which place he made his escape by sliding down a wire fastened to the side of the building. He was severely burned and received extended medical treatment in a hospital. The operator was uninjured. The photographs show the damage done to the plant.

Plant and Equipment

The building in which the explosion occurred was a two-story brick and frame structure used to house the drying unit of the system. The drying chamber (Fig. 1) was 14x14 ft. and 22 ft. high, with a hoppered bottom. It was built of wooden sheathing on each side of 2x4-in. scantling and lined with zinc over $\frac{1}{2}$-in. asbestos millboard. Part of it was in the first story and part in the second, extending up through the floor. The top of the chamber was equipped with two ventilators through which the air blown in at the bottom escaped. The bottom of the chamber was hoppered on a 45-deg. slope to a restricted outlet through which the powdered milk flowed to a screw conveyor. A number of nozzles entered the lower part of the spray chamber on one side, while on another side at right angles to them was an opening to which was connected the sheet metal duct that carried the air from the steam coils to the drier. In the upper part of the drier was a dust collector made up of thirty-six screens, through which the air passed before reaching the ventilators. It was connected to a motor-driven cam shaft so that it could be agitated from time to time and the dust collected shaken down into the hoppered bottom of the chamber. The capacity of the drier was 80,000 lb. of raw milk in a 24-hour day.

The heating unit consisted of 704 ft. if 1-in. black iron pipe assembled in eighty-eight 8-ft. lengths and inclosed in a metal casing. The steam used to heat it was brought through a 3-in. steam line from a boiler 250 ft. away, which was operating under 125 lb. pressure. To one end of the casing was connected a metal duct which led to the drier chamber; while to the other end

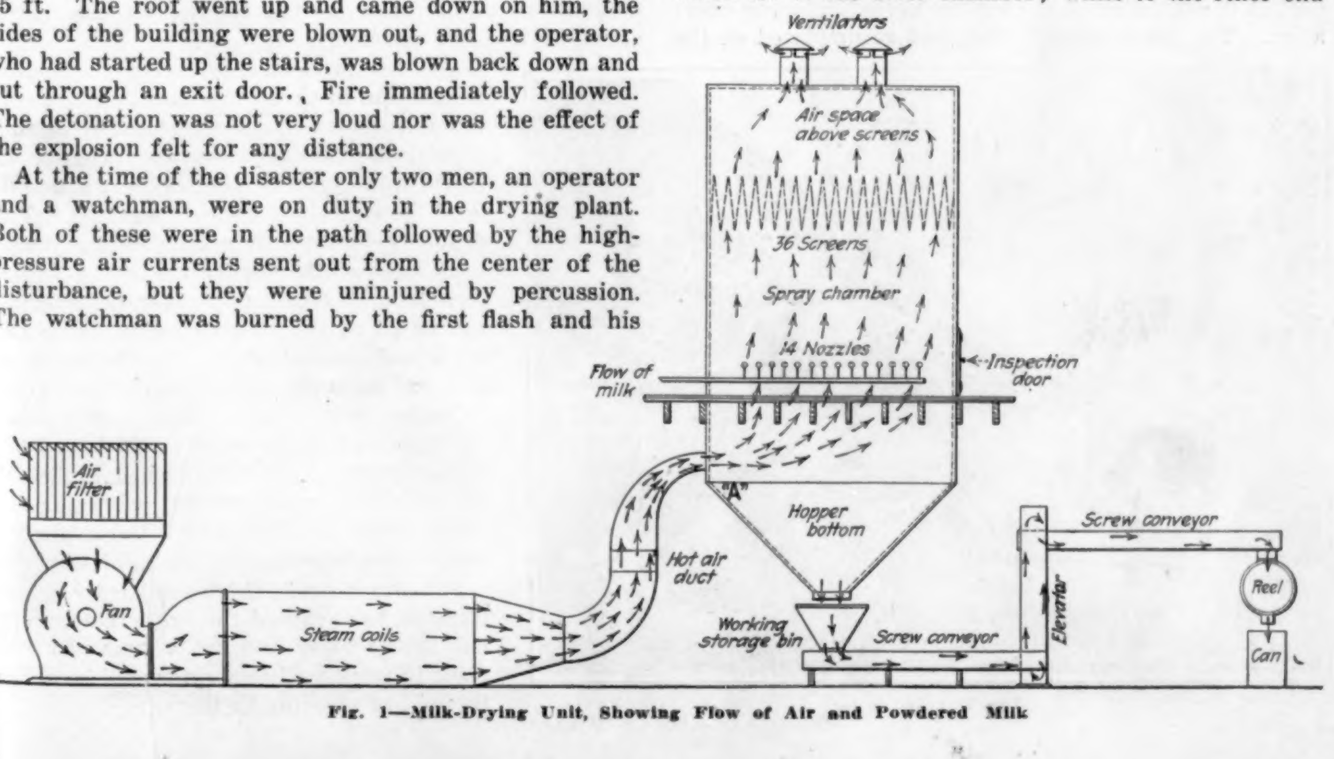
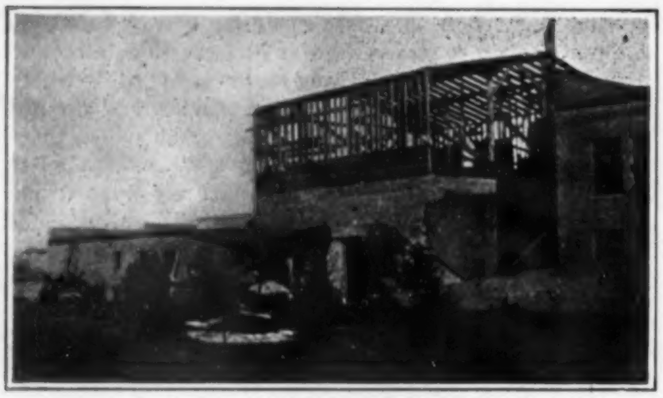


Fig. 1—Milk-Drying Unit, Showing Flow of Air and Powdered Milk



Reconstruction of Destroyed Drying Unit

was connected the outlet of a No. 6½ Turbo Conoidal fan. An air-filtering device was connected to the fan inlet for the purpose of removing foreign material from the air that passed through the heating unit and the drier.

MANUFACTURING PROCESS

Reference to Fig. 1 will aid in visualizing the course of the milk from the time it entered the drier until it was removed. After the milk was pasteurized, it was sprayed through fourteen nozzles into the drying compartment, where it was met by a blast of warm air, approximately 175 deg. F., striking it at a right angle. The air entered the chamber on a plane at a lower level than the milk and rose through it, carrying with it the water that evaporated from the milk and much of the solid matter to the screens of cotton flannel on wood frames built into the upper half of the drying chamber. These screens were covered with heavy cloth, which permitted the air to filter through but stopped the solid matter from passing on with it to the ventilators on the top of the drier. Owing to the retarding action of the screens, a 2-in. static pressure was built up. The operation was continuous in that it was carried on 24 hours a day, but the drier worked on the batch or charge principle—that is to say, the air currents and spray nozzles were shut off intermittently and the screens in the top of the drier were agitated, so as to shake down the fine dust that had collected during the period of spray operation. The powdered milk that had accumulated on the hoppered surface of the chamber was drawn off through the opening in the bottom to a reservoir of several barrels capacity. At this point the milk powder had approximately 3 per cent moisture content. From this storage, which was a hoppered bin, it fed into a screw conveyor, which carried the dried milk to a vertical elevator, where it was transferred to a screw conveyor on a plane sufficiently high to permit it to be fed into a round reel where it was bolted.

The shutting down of the mechanical equipment and the shaking down of the dust that had been collected by the screens, so that it floated in suspension over the fire, noticed on the hoppered bottom of the drier, was unquestionably the cause of the explosion. Definite knowledge of the origin of the fire, however, is lacking. Several possible causes, more or less plausible, have been considered:

Debris From Drier Building

(1) The location of the fire on the bottom of the drier, originating as it did, suggests that it may have started at this point by a short circuit in the electric wiring. This cause is dismissed, however, since there were no electric wires or motors attached to the drier at this point.

(2) Hot bearings appear to have no connection with this case, since there were no moving parts, hence no journals in the drier, except for the screens in the upper part of the chamber.

(3) Static electricity, often the source of ignition in threshing machines and cotton gins, seemed a possible cause in this explosion. The continuous spraying of liquid through the nozzles would doubtless generate electrical energy. The company had taken precautionary measures against the occurrence of an explosion from this source, however, in soldering the joints of the sheets of zinc lining the drier and grounding it. Furthermore, it does not seem plausible that this explosion followed ignition by a static spark, since in that case the explosion would have been instantaneous. As it happened, sufficient warning was given to the workmen by their seeing the fire before the explosion occurred to take steps to extinguish it.

(4) Smoking in this case hardly seems likely to have caused the fire. It was very hot in the drier and not a very pleasant place to work, so the operator said he never thought of smoking in there.

The Wrecked Drier

(5) Spontaneous combustion has a just place in our suspicions regarding this explosion. In the upper part of the drying chamber a number of screens covered with flannel were used as dust collectors. These screens, being covered by dust a long time and with hot air passing through them, furnishing both heat and draft, might eventually become ignited and let burning parts fall to the bottom of the bin, where the fire was first noticed by the operator. Owing to the high humidity in the drier while in operation and the unfavorable atmospheric conditions, the smoldering cloth might fall through the dust cloud without igniting it. But during operation a 2-in. static air pressure was maintained in the chamber, which, of course, would be reduced with the burning away of the screens. Such a supply of air as would be provided by a No. 6½ Turbo Conoidal fan and blown in at the bottom and out of the top of a 14x14x22-ft. chamber would carry the smoldering cloth out with it, unless the arrangement whereby the air entered was such as to cause eddy currents and zones of low pressure.

(6) Possibly the fire started from an overheated condition of the zinc on which the powder lay. This may have been effected by the comparatively high temperature of the air entering the drier chamber. If the pipe covering or insulating material on the sheet metal duct was such as to allow the duct to radiate heat to wood at that point, it may have, through a long period of time, so charred or carbonized it as to permit its ignition at a considerably lower temperature than would be possible in the case of sound wood. The heat produced by this destructive distillation, and radiated through the wall of the chamber, would then cause the powder to begin burning.

(7) A very likely source of ignition is the slow burning of a piece of waste left among the heating coils. In considering the slow burning of the waste as cause for the fire, it appears that 20 days before the explosion occurred the casing had been removed from the steam coils and the coils cleaned. It is possible that in cleaning them a piece of cotton waste might have been left among them and that this later became ignited and was blown from the coils to the drier, where it lodged on the side of the hoppered bin and continued to burn, also burning the powder adjacent to it until seen by the operator. The shutting down of the fan and shaking of the screens, which formed a dust cloud over the flame brought about conditions favorable to an explosion that one would expect to follow, and that did follow.

Recommendations and Conclusions

The first step to be taken in dust and fire explosion protection work by officials of companies engaged in this industry is to educate the employees to the dangers connected with their work because of the flammability of powdered milk. Good housekeeping methods should be followed. Accumulations of dust in the process of manufacture should be avoided, and dusty atmospheres guarded against ignition. The personal equation is a big factor in safety.

However conscientious and careful the workmen may be, their efforts to promote safety must be encouraged by the installation of proper mechanical equipment and safety appliances. To guard against the recurrence of an explosion from such a cause as burning waste being blown into the chamber, it is recommended that a wire screen be placed over the outlet end of the steam-coil heating unit to prevent the passage of such a thing as burning waste. Proper insulation at the point where the hot air duct enters the spray chamber should also be insured.

The cause of this explosion has been definitely determined, but the origin of the fire on the hoppered bottom of the drying chamber is unknown. A number of explosions and fires have occurred in driers and on heated surfaces[1] when the apparent temperature of the source of ignition—that is, steam-heated pipe—was considerably below the ignition temperature of the material before it was placed in the dryer or on the heated surface. It is very desirable that data be obtained in order that a clearer conception may be had of what actually takes place while the material is being heated.

[1]"Dust Explosions," Price and Brown, National Fire Protection Association, Boston, Mass., July, 1922. "A Lignone Dust Explosion," Edwards, *Paper Trade Journal*, Jan. 17, 1924.

Two Views of Drier Ruins

Heating an Evaporator With the Exhaust From Condensing Engines

A Device Designed to Act as a Condenser for Multi-Expansion Engines and an Evaporator for Chemical Plant Service at the Same Time

By Frank H. Nickle
Saginaw, Mich.

WE ARE frequently reminded of the fact that about 75 per cent of the heat abstracted from fuel is ordinarily dissipated in the condensing water that is used to maintain a vacuum on the engine. That this waste is unavoidable is the foregone conclusion in the minds of most engineers. This is because the temperature of very low-pressure steam is not high enough to permit its use as a heating medium in most industrial processes. This article deals with an evaporator designed especially in view of using such waste exhaust steam for concentrating solutions in vacua.

To distinguish this class of apparatus from the usual evaporator or vacuum pan, it is termed an "evaporative condenser," because it functions both as an evaporator for concentrating solutions and as a surface condenser for maintaining a vacuum on steam engines.

The use of exhaust steam from non-condensing engines at or about atmospheric pressure as a heating medium for evaporating solutions under vacuum is a common practice that dates back to the first vacuum pans operated in the Michigan salt and lumber industry more than a quarter of a century ago. The possibility of using low-pressure exhaust steam from compound or multi-expansion condensing engines, and maintaining a partial vacuum thereon, is not generally appreciated. By low-pressure steam, I have reference to exhaust steam ranging in temperature from 140 to 180 deg. F., corresponding roughly to a vacuum by gage of 24 to 15 in. of mercury, or 2.9 to 7.5 lb. per sq.in. absolute pressure.

Back in 1913 I was called upon to design a plant for concentrating caustic soda effluent from diaphragm cells. As this solution was weak and contained a large percentage of sodium chloride, it was imperative that economical means be found for concentrating it and eliminating the salt. Multiple effect evaporators, using live steam as a heating medium, were first considered. This idea was abandoned, because the investment was too great, and because there were too many mechanical complications involved in operating and unloading the salt crystals from the apparatus. Exhaust steam at or about atmospheric pressure was not available, the engines in the power plant all being compound condensing units, operating normally under a vacuum of from 24 to 26 in. of mercury. To utilize this waste steam, I attempted the design of a special vacuum pan, to operate as an evaporative condenser for maintaining a partial vacuum on a 350-kw. Nordberg direct-connected tandem compound engine. This apparatus, with engine and auxiliaries as outlined in elevation in Fig. 1, was erected and tested out during 1914.

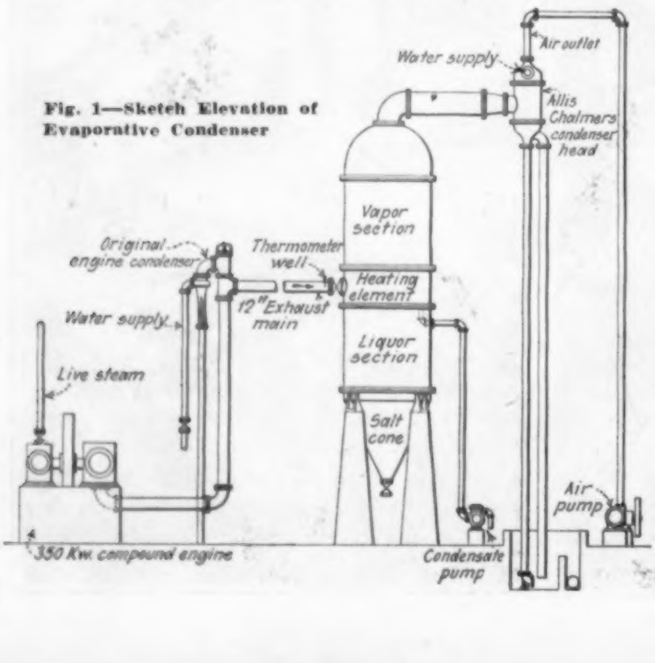


Fig. 1—Sketch Elevation of Evaporative Condenser

The evaporative condenser, resembling the conventional single effect vacuum pan with submerged vertical tubes, was made of five cast-iron flanged sections 8 ft. inside diameter. The bottom section was made conical to facilitate the removal of salt crystals. Directly above the cone was a relatively deep cylindrical section, which provided sufficient liquor and salt capacity underneath the heating element to permit batch operations. The heating element comprised a cast-iron steam belt, and upper and lower horizontal tube sheets into which 2-in. vertical tubes were expanded, making a total external tubular heating surface of 1,400 sq.ft. exposed to the heating medium, exclusive of a 30-in. diameter central downflow tube. In the cast-iron belt there was a 12-in. pipe connection, adjacent to which was a gate valve for controlling the exhaust steam from the engine. A 4-in. pipe connection to the bottom tube plate served as a outlet for the uncondensable gases and the condensate. The vapor section and the hemispherical dome were made relatively high in view of reducing entrainment losses without resorting to the usual inefficient catchalls. A 30-in. pipe connection at the top of the dome served as an outlet for the vapor.

The auxiliaries consisted of a 30x16-in. Allis-Chalmers barometric condenser for withdrawing vapor from the solution undergoing concentration; an 8x16x12-in. steam-driven rotative piston dry vacuum pump piped to withdraw air from the condenser head; an 8x10x12-in. steam-driven piston pump connected to the lower tube sheet for withdrawing the engine condensate and the uncondensable gases from the heating element; and two motor-driven centrifugal pumps, piped to the cone for

unloading the concentrated liquor and salt crystals and elevating them to filter tanks. Mercury columns, thermometer wells, sight glasses, water gage and liquor testers were provided, likewise the usual pipe connections for wash water, feed liquor and vacuum break.

The original jet condenser operating on the engine was left intact, except for a 12-in. pipe connection being made in the vertical exhaust riser for delivering steam to the evaporative condenser. The engine was operated on 24-hour service, while the evaporative condenser was operated intermittently, the runs being from 6 to 10 hours' duration. Preceding the admission of steam to the heating element of the evaporative condenser, the vacuum pumps were started and the apparatus filled with weak liquor up to a point a few inches above the upper tube sheet. After exhausting the air from above the liquor, likewise from the steam chamber of the heating element, the 12-in. valve was opened for the admission of exhaust steam from the engine. As soon as active boiling of the liquor commenced, the use of the original jet condenser on the engine was discontinued by cutting off the water supply. This was again turned on and the original engine condenser allowed to pick up the load always before cutting the evaporative condenser out of commission. Although the evaporator house and the engine room were separated by a considerable distance, no operating difficulties were encountered, providing the attendant co-operated with the engineman in starting and stopping the evaporative condenser. The operating and unloading of the concentrate and salt crystals were conducted by one man. The vacuum on the evaporating solution was maintained as high as conditions permitted. In this respect, if the vacuum fell from 28 to 27 in. of mercury, the corresponding drop in the heating element was substantially 4 in., or in other words, the back pressure on the engine was increased about 2 lb.

Experimental runs were made on water, raw salt brine, calcium chloride and electrolytic caustic soda. With water as the solution undergoing evaporation, the performance is shown graphically in Fig. 2. This was a 4-hour test, during which time the lowest vacuum on the engine exhaust at the 12-in. valve was 21.5 and the highest 24.5 in. of mercury, the corresponding vacua on the evaporating water being 27.2 and 24.5 in.

Operating on caustic soda-brine, the performance is shown graphically in Fig. 3. This run was made to see

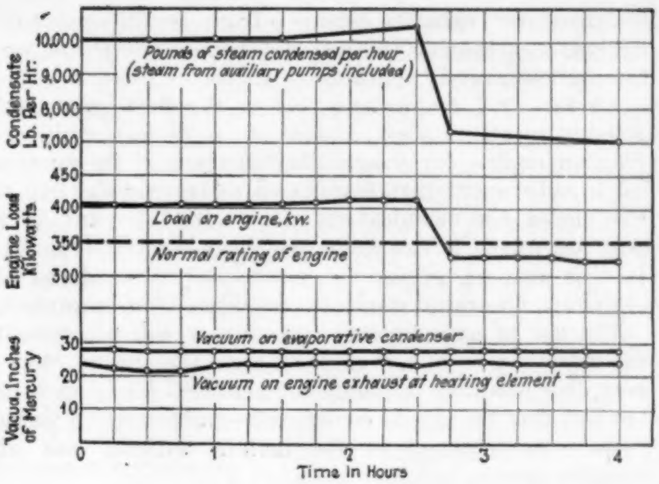


Fig. 2—Performance Curves of Evaporative Condenser When Operating on Water.

how far the concentration of the solution could proceed without loosing the vacuum on the engine. It covered a period of nearly 17 hours, during which time the density of the solution was brought up to 49 deg. Bé. hot. At this stage the tubes became salted and the back pressure on the engine increased rapidly. Owing to the considerable depth of liquor below the heating element, there was a tendency for the liquor to stratify and test heavier at different elevations. To overcome this, the two centrifugal pumps above mentioned were piped and operated so as to maintain an active circulation of the liquid contents below the heating element. At intervals one of these pumps was used for withdrawing salt crystals and liquor from the cone, the object being to ascertain the possibility of operating the evaporative condenser continuously. During the last half of the run the evaporative condenser was unable to take all of the exhaust from the engine, as it was carrying a load of 440 kw., or about 26 per cent overload. The excess steam was condensed by operating the original engine condenser simultaneously in conjunction with the evaporative condenser. This was not a typical run, as the usual practice was to concentrate the caustic soda only far enough to effect the crystallization of the sodium chloride, the final concentration being carried out in another evaporator.

AVERAGE PERFORMANCE OPERATING ON NATURAL BRINE

	Run No. 10	Run No. 11
Date	1-15-1924	1-17-1924
Vacuum on brine, inches in mercury	27	27.5
Vacuum on engine exhaust at 12-inch valve*	20.3	21.4
Temp. of exhaust steam supply, deg. F	160	155
Temp. of brine supply, deg. F	47	62
Temp. of injection water to condenser	39	39
Temp. of ejection water from condenser	86	89
Density of brine supply, deg. Bé*	18.5	....
Density of brine concentrate, deg. Bé	25	28
Steam supplied to heating element, lb–hr	9,759	9,025
Steam from auxiliaries, estimated, lb–hr	860†	860*
Steam from engine, net, lb–hr	8,890	8,165
Load on engine, kw	408	368
Apparent steam consumption of engine, lb. per kw-hr.	21.8	22.2

*The original engine condenser was maintaining a vacuum of 24½ in. before the evaporative condenser was placed in service.

† The approximate steam consumption of the auxiliary pumps was determined subsequently under similar conditions as to load and r.p.m.

These data were obtained under ordinary operating conditions and without refinement. The weight of the condensate from the evaporative condenser was determined by tank measurements. The mercury column readings are not corrected for standard barometer. The same applies to the graphs in Figs. 2 and 3. The results, however, are substantially correct, and in a measure will serve to indicate the possibilities of utilizing

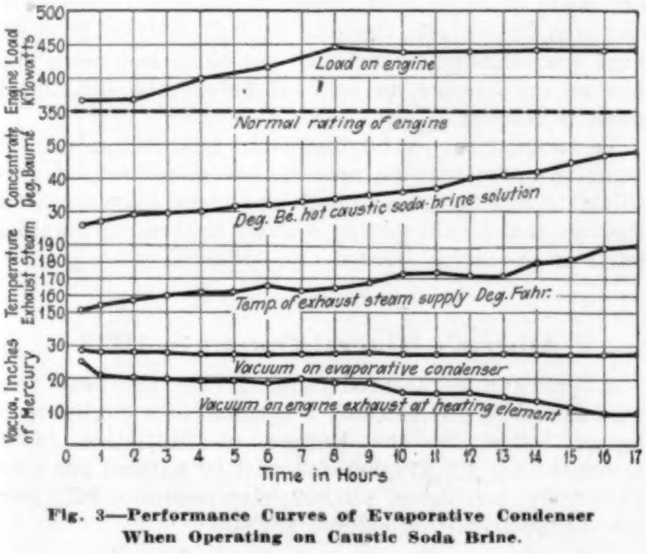


Fig. 3—Performance Curves of Evaporative Condenser When Operating on Caustic Soda Brine.

low-pressure exhaust steam from multi-expansion engines as a heating medium for evaporating or concentrating low gravity solutions in vacua.

So far as I am aware, this is the first successful attempt to utilize such exhaust steam from a multi-expansion engine for evaporating purposes. Its success led to subsequent installations on a larger scale, and it has placed one chemical manufacturing company in a position where it can boast of cheap electrical power. In this respect, either the power or the products of evaporation were substantially considered as a byproduct.

The use of an evaporative condenser will not permit the maintenance of a high vacuum on the engine; however, this loss may be partly compensated for in view of the fact that the engine condensate—pure distilled water—may be returned to the boilers without loss of sensible heat.

The evaporative condenser, virtually a single effect vacuum pan, points the way to the possible utilization of large quantities of heat that is now being dissipated in jet and surface condensers. The field of application includes the producers of steam-electric power who have occasion to evaporate or concentrate large quantities of salt brine or other low-gravity solutions.

What Is Good Galvanizing?

Some Points of Importance to the Consumer of Galvanized Iron Ware

By S. Rosenberg
Inspector, The Panama Canal

WHAT method of hot dip galvanizing is the best and how can the product be recognized by the purchaser? This is a question that has been answered in many ways, most of which are wrong. The layman usually says that the galvanizing showing "spangles" is prefered. Undoubtedly it is, or at least it has been, but whether or not it stands up better than a blue-gray coating is another question. A brief survey of the facts regarding the corrosion resistance of galvanized iron may help in answering the question correctly.

One of the most satisfactory methods yet devised for checking the atmospheric corrosion of iron is the coating of the iron with zinc by immersion in the molten metallic bath. The coating protects the iron at the expense of the zinc itself. In the presence of moisture any two metals in contact form an electrolytic cell, the more electropositive of the two metals going into solution and the other remaining unattached. Zinc, being electropositive with respect to iron will, in the case of galvanized iron, be gradually consumed, leaving the iron unharmed until the zinc is gone. If the galvanizing has been well done, the iron will be protected for half a century under ordinary corrosive conditions.

There are other metals besides zinc that are electropositive to iron and that would protect iron in the same way to a greater or less degree, but none of them is as cheap or as plentiful as zinc. One of these metals is aluminum. If it is added to the zinc used in galvanizing, it gives the coating an appearance similar to that produced by tinning, but it renders the coating more durable than if zinc is used alone.

Tin, nickel, lead and copper are electronegative to iron and if one of them is used as a protective coating, it provides protection only as long as the covering metal is non-porous and continuous. When even the tiniest of apertures appears, the electrochemical action set up begins the destruction of the iron. In the case of nickel plating, for example, the iron almost immediately begins to rust under the nickel covering and if conditions are bad, the nickel, although it remains uncorroded, can soon be peeled off easily.

This leads us to the consideration of "spangled" galvanizing, for the spangled effect is produced by the presence in the zinc bath of a quantity of tin or lead. The pleasing appearance is obtained at a cost of reduced resistance to corrosion, for these metals, being electronegative to iron, render a coating containing them less effective.

The Preece test for galvanizing consists of the immersion twice or three times, of the article in a solution of copper sulphate of specific gravity 1.186 at 70 deg. F. with thorough drying by wiping after each immersion. This test is widely accepted in the inspection of galvanized material and is the standard test of the Underwriters Laboratories, the United States Navy, the Panama Canal and other large organizations. At a plant recently visited by the writer this method was used in a series of experiments for comparing three types of galvanizing.

In one experiment three ring bolts 1 in. thick and 12 in. long were treated as follows:

Bolt *A* received a coating of zinc only.

Bolt *B* received a coating of zinc containing tin.

Bolt *C* received a coating of zinc containing aluminum.

Time, temperature, size of bath and other important conditions were maintained constant. When the Preece test was applied

Bolt *A*'s coating failed after eight immersions.

Bolt *B*'s coating failed after three immersions.

Bolt *C*'s coating failed after fourteen immersions due to faulty manipulation it had received in the galvanizing bath.

In so far as this experiment is of value the utility of the zinc-aluminum coating is evident.

Variation in the gage of the iron may have a serious effect on the durability of the coating produced in galvanizing. It is well known that the bottoms of ash cans usually fail before the sides of the cans. While the fact that the bottoms of the cans bear the brunt of the abuse is an important factor, it is not the whole story. From the very fact that they must stand abuse the bottoms are made of extra heavy sheet; consequently when the can is removed from the zinc bath the bottom holds its high temperature longer than the sides and more zinc has an opportunity to drip off before the solidifying point is reached.

To summarize: In buying, avoid spangled galvanized iron; in operating the process, use aluminum, if anything, to add to the zinc bath and make allowances for the fact that a thin coating is likely to form on the thick parts of the article treated.

Alberta's Mineral Output in 1923

Alberta's mineral production during the past year was valued at $31,646,000, according to a preliminary report issued by the Bureau of Statistics. Coal accounted for $28,278,000, followed by natural gas with $1,700,000; petroleum, $30,902; clay products, $612,000; cement, $740,000; quicklime, $37,600.

Using Refrigeration for

Removing Salts from Solution

A Practical Example of the Proper Method of Employing Low-Temperatures as an Aid to the Crystallization Process

By H. J. Macintire
Associate Professor of Refrigeration, University of Illinois

CERTAIN salts in solution may be extracted best by means of crystallization and precipitation incidental to the lowering of the temperature. For example, a saturated solution of sodium nitrate at 90 deg. C. will hold in solution 162 grams of salt in 100 cc. of water; but at 20 deg. C. the amount will be reduced to 85 grams; and the difference, 77 grams, must be precipitated out of solution. As the object of this series of articles is to show the practical applications of refrigeration in the field of chemical and metallurgical engineering, the following problem is worked out as an illustrative example:

Water to the amount of 10,000 lb. saturated with potassium chlorate ($KClO_3$) is to be cooled from 68 deg. F. to 14 deg. F. per hour. Find the refrigeration and the piping required for the heat transfer.

One arrangement of the apparatus required is as shown in the Fig. 1. This apparatus consists of two cylindrical tanks with conical bottoms, the latter fitted with cocks of ample size for quick operation. Referring to the figure, it will be seen that the strong solution enters the left hand tank at 68 deg. F. and passes downward, being cooled on the way, with precipitation of some potassium chlorate crystals, and finally passes over into the second tank by means of the difference in level or by means of a pump. In the second cylindrical tank is arranged a helical coil for brine cooling, the brine entering at 5 deg. F. and leaving at 20 deg. F. The solution is thereby lowered in temperature to 14 deg. and leaves the tank at this temperature, to be pumped through a helical coil in the first tank, where it leaves at about 60 deg. F. The first tank is therefore simply a heat exchanger, intended to give economy of action by the utilization of all the refrigeration existing in the liquid after the process that it is practical to attempt to use.

REFRIGERATION

Articles by Woolner and by Macintire, published in *Chem. & Met.* during the last 10 months, have established a sound theoretical background for the chemical engineer who uses refrigeration in his work. The current article takes as an example a practical application of refrigeration and shows the calculations that must be used to ascertain what results may be expected. This constitutes the first of several articles to be published in these columns on refrigeration in the chemical engineering industries.

A UNIT PROCESS OF CHEMICAL ENGINEERING

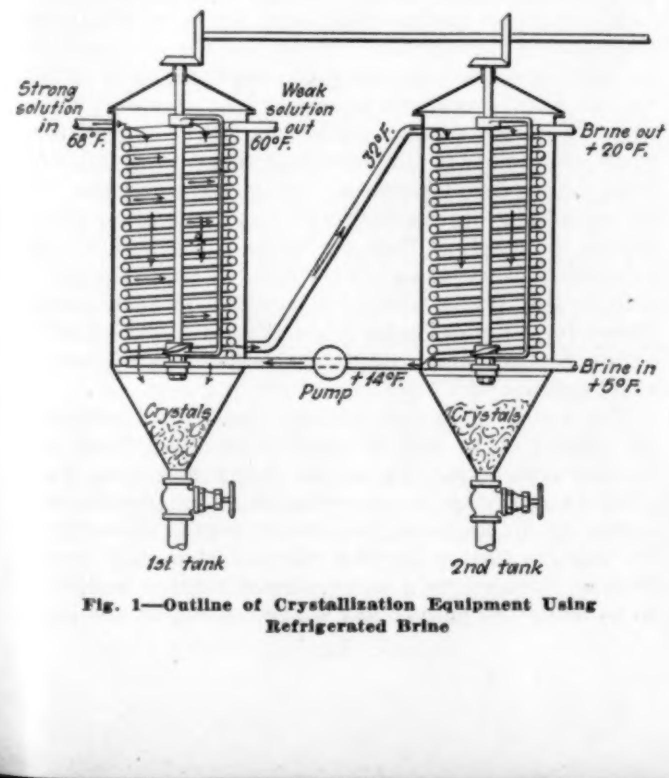


Fig. 1—Outline of Crystallization Equipment Using Refrigerated Brine

As the crystals will tend to form on the cooling coils, it is necessary to provide some means of continually scraping them, and this is done by wire brushes attached to the vertical shafts, as shown in the figure. The crystals settle into the conical part of the tank and are drawn off into another tank, the upper part of which is separated from the lower by means of a wire screen so that what liquid passes along with the crystals will pass through the screen.

To precipitate the potassium chlorate there will be required 146.7 B.t.u. of refrigeration per pound of crystals formed. Referring to Fig. 2, 7.4 — 2.2 = 5.2 grams of salt is precipitated per 100 cc. of water, or 5.2 per cent of the weight of the water of solution is the weight of salt separated. Therefore 5.2 per cent of 10,000 lb., or 520 lb., of crystals per hour will be produced. During the process in the first tank the weak solution will be heated from 14 to 60 deg. F. and the heat absorbed will be:

$$Q = 10{,}220 \times 0.85 \times 60\text{—}14 = 400{,}000 \text{ B.t.u.}$$

and the strong solution will lose an equal amount of heat as heat of the liquid and as heat of solution. By trial and error it works out that, by allowing for losses through the insulation, the temperature of the strong liquor leaving the first tank will be 32 deg, and that the strong liquor will be reduced to a concentration of 3.3 grams per 100 cc. of water. Thereby 410 lb. of crystals will be precipitated, and the remainder, 110 lb. of potassium chlorate, will be deposited in the tank with the brine coil. The load on the brine coil will be (taking the specific heat of the salt solution as 0.85):

$$Q = 10{,}270 \times 0.85 \times 32\text{—}14 + 0.011 \times 146.7 = 173{,}300 \text{ B.t.u.} = 14.44 \text{ tons of refrig.}$$

To this 14.44 tons must be added 5 per cent for losses through the insulation, which makes the total load on the refrigerating machine 15.16 tons. The machine displacement would be 15.16 × 4.7 = 71.3 cu.ft. per minute (for 15 lb. suction and 160 lb. condenser pressure) and the horsepower required to drive the compressor 1.42 × 16.16 = 21.54 hp. A larger motor, however, will be required for starting and for a factor of safety. For this sized compressor the best design is the single acting vertical inclosed type, which operates at about 200 r.p.m., in which case the size works out to be 7.3 × 7.3 in., so that the 7x7 in. or the 7½x7½ in.

standard sizes would be used with the proper speed in order to obtain the piston displacement required.

The type of ammonia condenser depends on local conditions. As a rule the so-called "bleeder" type of atmospheric condenser is best, and (using 10 sq.ft. of condenser surface per ton of refrigeration) there will be

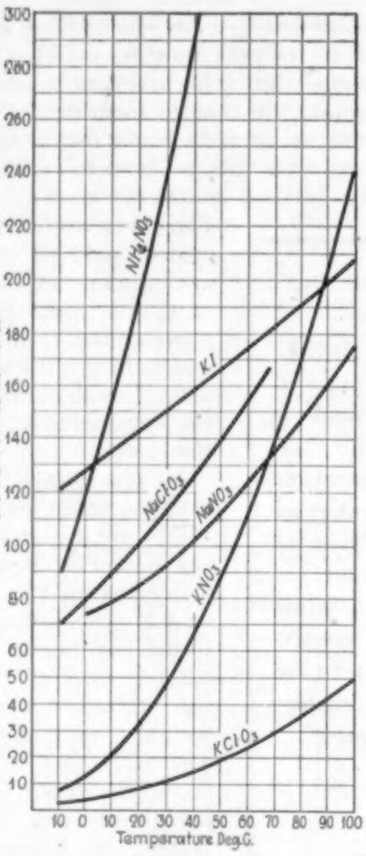


Fig. 2—Amounts of Salts Held in Solution at Various Temperatures

required 15.16 × 10 = 152 sq.ft. of condenser surface. Using 2-in pipe, this will require 152 × 1.6 = 243 linear feet of pipe.

The amount of pipe surface for the coils in the tanks may be considered from the following viewpoint. The inside of the coil will be kept free of crystals because of the action of the rotating brushes, and the propeller

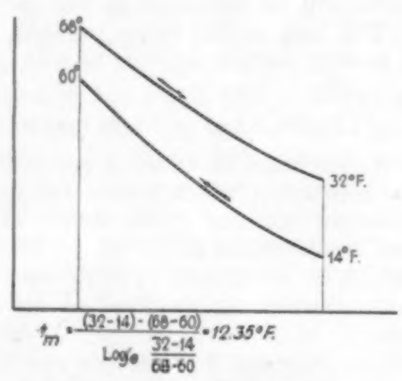


Fig. 3—Curve for Logarithmic Mean of Temperatures in Crystallization Device

will keep the liquid agitated. A value of 50 to 75 for the coefficient of heat transfer is justified if all the surface is effective, but as it is coated with crystals on the outer surface, it will be safer to use 40. The mean temperature difference in the first tank (the logarithmic mean) is 12.35 deg. (Fig. 3) and the surface becomes:

$$400{,}000 = \text{area} \times 40 \times 12.35$$

$$\text{area} = 810 \text{ sq.ft.} = 1295 \text{ ft. of 2-in. pipe}$$

This surface could be provided in a coil 8 ft. in diameter with 52 turns. If the pipe coil has a pitch of 3-in. the coil would be 13 ft. high, with ⅝ in. between pipes. In a similar manner the pipe coil required for the second tank would be 416 sq.ft., or 670 lin.ft., of 2-in. pipe. The two tanks should be covered with 4 in. of corkboard.

Polysulphide Pulp Production

A Method for Using Wood Waste in Making Strong, Non-Bleachable Pulp—Disintegration Is Partly Chemical, Partly Mechanical

A METHOD FOR the preparation of unbleachable woodpulp that has several unusual features is described by its inventor, Dr. Alfred Tingle, of the University of Oregon, in a recent issue of *Paper*. Starting with several definite objectives including the use of cheap and readily handled reagents, the attainment of simplicity in plant equipment, the production of strong fibers, chemically disintegrated to a low degree, Dr. Tingle arrived at a modification of the process patented by Drewsen in 1911 (U. S. No. 996,225).

Calcium polysulphide is the cooking reagent employed, being prepared directly from quick lime and sulphur 2:1 by weight. For 1,000 lb. of air-dry chips a total of 200 lb. of these reagents is required. As little water is used as will barely cover the chips.

The time and pressure of steam necessary vary somewhat with the size and nature of the chips. Spruce chips prepared for sulphite digestion have been found to cook very well at a pressure of about 65 to 75 lb. for 10 to 12 hours. Shavings seem to cook more quickly, but owing to the very mild action of the liquor, overcooking has never been known to occur. There is evidently no danger that fine material will be spoiled if digestion is prolonged to complete the action on knots and larger and harder chips. At the close of the cook the liquor is dark brown. It has an offensive smell, but appears to contain no inorganic sulphides, and nothing that is worth recovery in our present state of knowledge. The cooked chips are brown. They have retained their original form but are more easy to disintegrate than before the treatment. It is advantageous (but not necessary) to wash the chips at this stage with a stream of water, if they are to be worked up at once. Unwashed, they may be stored without danger of deterioration for a considerable time. In fact, samples stored for six months have been found to give a rather better product than similar material treated without any interruption.

The second stage of pulping consists in acting on the cooked chips with a reagent capable of removing calcium compounds, the action being meantime facilitated by crushing the material in a beater with blunt knives or in an edge runner or similar contrivance. By using a beater for this purpose it is easy to pass from a crushing to a more normal beating action and so to bring the pulp to any stage desired by the paper-

maker. If the chips are beaten at this point with water alone the resulting pulp is harsh and the fiber bundles do not separate well.

Dilute sulphuric acid has been used with success, but excellent results have been obtained by running the waste sulphite liquor fresh from the sulphite digester over the chips and beating them in this, preferably while still warm. The color of the pulp varies somewhat with the nature of the acid used, but though sulphite waste generally gives a darker tint than for instance, sulphuric acid, there is less danger of injury to the fiber, and its cheapness is a great advantage. Experimentally, good pulping results have been obtained by using oxalic acid, sodium oxalate and alkalis. Acetic acid is quite ineffective for the purpose.

Sulphite Liquor Used in Beater

As the sulphite liquor penetrates the fiber the latter becomes softer, enabling the beater roll to fulfill its normal purpose. Care is required in handling the roll, as need hardly be pointed out to any maker of paper, or it may cut the fibers into short lengths instead of crushing out the bundles. The supply of sulphite liquor must be large enough to insure that its reaction to litmus remains acid.

The use of steel beater bars would be somewhat objectionable; bronze is less attacked by acids and is therefore ultimately cheaper.

When beaten to the desired extent, the pulp should be discharged, washed, screened for the removal of shives and then concentrated in the usual manner. These operations require no description.

The product, though varying in shade according to the precise treatment, is always brown. It is therefore only suited for the darker grades of wrapping and bag papers, but when skillfully handled its fibers are very tough and if they have not been too much shortened by the manner of cutting the original chips a very strong paper can be produced.

Pulp Yields High

When it is remembered that the yield of pulp is high (it seems quite safe to claim 70 per cent of the weight of wood and this figure may be exceeded by careful engineering precautions), it will be obvious that it is not even approximately pure cellulose which has been produced, and that therefore bleaching is out of the question.

Most of the lignin originally present in the wood fiber and remaining in this polysulphide pulp is so altered as to be much more stable than before to air and light. This was well shown when a sample of paper made from this fiber was exposed to direct sunlight for more than three months. At the end of that time there were no signs of deterioration, the only obvious change being a slight bleaching. No such result could be hoped for from untreated wood lignocellulose.

The nature of the chemical reactions involved in this process is obscure. It is safe to say that it will never be quite understood till the chemistry of lignin itself has been put on a proper basis—such theoretical deductions as have been made are not discussed. The immediate point of interest is that a strong fiber, little inclined to deterioration, can be produced by the use of a material most of which is at present waste from an allied process, and in a plant the necessary equipment of which is relatively simple, so that the capital locked up is small, while there are few if any in the way of new engineering problems to meet.

Ammonium Nitrate as an Explosive

By Russell M. Cook

Reynolds Experimental Laboratories, Atlas Powder Co., Tamaqua, Pa.

In recent discussions of the explosibility of ammonium nitrate a number of well-known authorities have emphasized the possibility that small percentages of an organic impurity might have a marked effect on the sensitiveness of the compound toward detonation. This paper describes some interesting experiments that seem to offer striking confirmation of the impression so generally held by the explosives industry.

THE explosives industry has for a long time been acquainted with the fact that ammonium nitrate readily enters into and contributes to explosives mixtures, and under conditions can be brought to detonation without being mixed with other explosives. It is not the purpose of this article to go into a detailed discussion of various experiments that have been carried out with regard to the detonation of ammonium nitrate under many different conditions. Charles E. Munroe[1] has given an excellent review of the subject, which includes not only an immense amount of experimental work by the du Pont company but an analysis of accidents involving ammonium nitrate. In general, the evidence shows that ammonium nitrate of itself can be detonated, but with very great difficulty, and that it will propagate its own wave of detonation, but that this propagation falls off very quickly.

In an article entitled "The Influence of Confinement Upon Explosibility of Ammonium Nitrate," J. L. Sherrick[2] presents some well-planned and well-executed experiments from which he draws some logical conclusions, two of which are as follows:

1. Confinement is very effective in promoting the detonation of ammonium nitrate charges.
2. The detonation of ammonium nitrate appears to be the result of an induced wave of detonation from the booster or initiator, and such wave is propagated with diminished rate and intensity as it proceeds. The distance to which the wave is propagated depends upon the rate and intensity of the induced wave and certainly also upon the degree of confinement of the nitrate charge.

One of the latest contributors to the subject, Dr. Rudolf Aufschlager,[3] says: "Even unconfined ammonium nitrate can be detonated with certainty, although with greater difficulty than when confined, provided that the initial impulse is sufficiently strong. . . . this is the case not only for specially prepared (thoroughly dry, ground or finely crystalline) ammonium nitrate, but also for the raw, somewhat moist, technical product."

Too Many Generalities

Any criticism that may be made of the above-quoted conclusions must necessarily be tempered with a realization that the subject is an intricate one. A compound that possesses seven different methods of decomposition

[1]"The Explosibility of Ammonium Nitrate," *Chem. & Met.*, vol. 26, pp. 12 and 535, 1922.

[2]*Army Ordnance*, vol. 4, No. 23, 1924. (See also *Chem. & Met.*, vol. 30, No. 16, p. 623 (1924).

[3]"Is Ammonium Nitrate an Explosive?" *Chem. & Met.*, vol. 30, No. 16, pp. 619-21 (April 21, 1924).

may circumvent the skill and genius of the investigator. Moreover, the conclusions to date are too general. The statements that "Confinement is very effective in promoting the detonation of ammonium nitrate" and "The detonation of ammonium nitrate appears to be the result of an induced wave of detonation, which is propagated with diminished rate and intensity as it proceeds" are generalities known to every manufacturer and consumer of explosives. Likewise the conclusion that ammonium nitrate is difficult to detonate, but once detonated is very brisant, as proved by its velocity of detonation, contributes very little if anything new to the subject. The highly destructive action of ammonium nitrate, once detonated, is proved by the effect and result of explosions in which it has been involved. Moreover, statements to the effect that ammonium nitrate, confined or unconfined, specially prepared and dry, or raw and moist, can be detonated with certainty, provided the initial impulse is sufficiently strong, may very easily create an incorrect impression. There are no doubt a number of chemical compounds that could be completely consumed in moderate quantities by five No. 8 blasting caps or by the detonation of 400 grams of picric acid, but that would not be considered as explosives.

Evidence as presented by Dr. Aufschlager does not entirely justify the conclusions that are drawn. That 10 grams of ammonium nitrate in the Trauzl test was completely detonated by a No. 8 cap is open to serious question. The "detonation" of 12 kg. of ammonium nitrate packed in a wooden box, by 400 grams of compressed picric acid, is not borne out by the evidence. The formation of a large, reddish brown cloud of oxides would indicate that burning rather than detonation had taken place.

The above criticisms having been made, the question naturally arises, "What then are the governing factors in the case?" That ammonium nitrate can detonate seems to have been proved by the explosions in which it has figured. There is one phase of the subject which, according to the literature, has received scant attention. That is the effect of organic impurities on the sensitiveness of ammonium nitrate to detonation.[4] In the discussion by Dr. Munroe, above referred to, of the Oakdale and Repauno ammonium nitrate explosions, it was pointed out that in both cases weak nitric acid recovered from TNT waste acid was used for the neutralization of the ammonia liquor, with the explanation that nitrobodies in the nitric acid may have had something to do with initiating the explosions. Dr. Aufschlager made two experiments, adding 1 per cent of coal dust and 2 per cent of wood pulp to the ammonium nitrate, and as a result concluded that sensitiveness is increased by small amounts of organic impurities. There are given below the results of some experiments carried out at this laboratory.

A good grade of commercial ammonium nitrate containing about 0.10 per cent moisture and 2 per cent ammonium chloride and of such fineness that all passed a standard 100-mesh sieve was used for the experiments. The following different kinds were used: (1) Straight 100-mesh uncoated. (2) Mixed dry with ½ per cent TNT. (3) Mixed dry with 1 per cent TNT. (4) Coated with 1 per cent petrolatum (molten). (5) Coated with 2 per cent petrolatum.

Materials were purposely selected, one of which is an explosive by itself and one not an explosive. Using these five kinds of ammonium nitrate, three sets of experiments were carried out as follows, each set involving an increased order of confinement.

1. Explosive effect, in a ballistic mortar, of 5 grams of ammonium nitrate, primed with 5 grams of blasting gelatine and a No. 6 cap.
2. Explosive effect of 160 grams of ammonium nitrate, tamped in a concrete cylinder 5¼ in. in diameter, with a 1¼-in. bore hole, primed with a No. 8 cap, and fireclay stemming used at both ends.
3. Explosive effect of about 250 grams of ammonium nitrate, tamped in a 1¼x8-in. pipe nipple with pipe caps at both ends. No fireclay stemming used. Hole drilled in one end for fuse. No. 8 cap used.

Effect of Slight Confinement

The ballistic mortar used in Experiment No. 1 was the usual American type, by which strength of explosives is determined. A mortar is suspended as a pendulum. The explosive to be tested is placed in a cavity in the mortar, and the charge primed with a No. 6 cap. The fuse is passed through a small hole in a cylindrical piece of steel which is used to close the cavity in the mortar. The detonation throws this cylinder out, the mortar recoils and the swing is measured on a graduated arc. Results were as follows:

	Swing of Mortar Average of Five Trials
5 grams gelatine and No. 6 cap	13.71
Gel. and cap with 5 grams NH_4NO_3 (uncoated)	18.57
Gel. and cap with 5 grams NH_4NO_3 (coated 0.30 per cent petrolatum)	18.57
Gel. and cap with 5 grams NH_4NO_3 (coated 1.0 per cent petrolatum)	19.00
Gel. and cap with 5 grams NH_4NO_3 (coated 2.0 per cent petrolatum)	19.13
Gel. and cap with 5 grams NH_4NO_3 (mixed 1.0 per cent TNT)	18.85

It will be noted that uncoated ammonium nitrate with the primers gave a swing considerably greater than that obtained with the primers alone, thus indicating that the salt gave off gas. Some unconverted ammonium nitrate remained in the cavity and it is probable that the gas given off was only as the result of heat from the explosion of the cap and gelatine. When ammonium nitrate was used which was coated with 0.30, 1.0 and 2.0 per cent of petrolatum, there was a gradual increase in the swing, 18.57 to 19.00, and 19.00 to 19.13. However, the increase over uncoated ammonium nitrate was not very great—in fact, 0.30 per cent coating gave no increase. One per cent TNT gave a slight increase, which was not as great as 1 per cent or 2 per cent petrolatum.

These results would indicate that ammonium nitrate under the slight confinement afforded by the mortar does not act as an explosive when primed with a No. 6 cap and blasting gelatine. However, there was a development of gas, which was probably only a result of the intense momentary heat. The effect of impurities was slight. When only a No. 6 cap and the ammonium nitrate with no blasting gelatine were used, there was little if any recoil.

For purpose of comparison it might be said that in this test 7.5 grams of 40 per cent straight dynamite and No. 6 cap give a swing of about 13.00, 10 grams gives 16.00 and 12.5 grams 18.00.

In Experiment No. 2 concrete cylinders were used, having a round bore hole of 1¼ in. diameter. Dry fireclay was tamped in with a wooden tamp stick. 160 grams ammonium nitrate tamped in, a No. 8 cap inserted in the center of the diameter so that the top end was below the surface. Dry fireclay was tamped around the fuse to the top. In one case only a No. 8 cap with

[4] See comment of Norman and Bashford, *Chem. & Met.*, vol. 30, No. 16, pp. 622 (April 21, 1924).

fireclay stemming was used. The No. 8 cap alone broke the concrete and reduced it to fragments about the size of a baseball. The ammonium nitrate with the cap in each case broke the cement to smaller fragments, but little if any distinction could be made among the different kinds of ammonium nitrate. There was slight indication that the sample containing 1 per cent of petrolatum gave the finest fragmentation. The ammonium nitrate was not completely consumed in any case.

Effect of Organic Impurities

In Experiment No. 3 $1\frac{1}{2}$x8-in. pipe nipples with pipe caps at both ends were used, thus affording considerably greater confinement than in the first or second experiments. A small hole was drilled in the center of one cap for the passage of the fuse, to which was crimped a No. 8 blasting cap, which was completely covered by the ammonium nitrate. The charge was tamped with a wooden tamp stick. A No. 8 cap using fireclay and no ammonium nitrate was tested for comparison. A half glycerine drum was placed over the nipple in each test. The results are shown in Fig. 1.

In none of these tests was the ammonium nitrate completely consumed. In No. 5, with 1 per cent petrolatum, there was only a small amount remaining in the pipe cap, and none could be found under the drum.

These results show the decided effect of a small percentage of an organic material in increasing the sensitiveness of ammonium nitrate to detonation. The maximum effect was shown by 1 per cent of petrolatum. Two per cent of this material caused less fragmentation but probably a more brisant action than 1 per cent TNT, which had a greater effect than $\frac{1}{2}$ per cent TNT. Uncoated ammonium nitrate, on the other hand, caused very little more rupture than a No. 8 cap alone. It is of interest that a non-explosive material, petrolatum, gave a greater effect than TNT, which is of itself a sensitive brisant explosive. The method of incorporation may have had some effect on this difference.

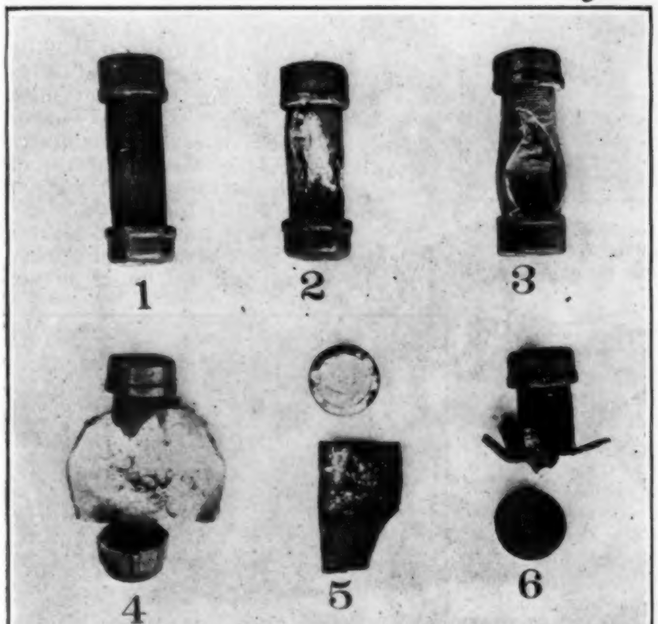


Fig. 1—Tests Showing the Decided Effect of Organic Impurities on the Explosibility of Ammonium Nitrate

1—No. 8 cap only. Barely ruptured pipe at seam. Crack $\frac{1}{8}$ in. at widest point.

2—No. 8 cap and uncoated ammonium nitrate. Only slightly greater rupture than in No. 1. Crack $\frac{1}{4}$ in. at widest point.

3—No. 8 cap and ammonium nitrate mixed with $\frac{1}{2}$ per cent TNT. Pipe was ruptured much more than in No. 2, but there was no fragmentation.

4—No. 8 cap and ammonium nitrate mixed with 1 per cent TNT. Pipe was ruptured considerably more than in No. 3 but there was no fragmentation.

5—No. 8 cap and ammonium nitrate coated with 1 per cent petrolatum. In this case fragments pierced the glycerine drum, one cap was completely shattered, and only two fragments of any size were recovered. One was one cap and the other, a piece of the pipe, was only about $2\frac{3}{4}$x4 in. in size.

6—No. 8 cap and ammonium nitrate coated with 2 per cent petrolatum. The fragmentation was not nearly as great as in No. 5.

A Possible Explanation

An exact explanation of these phenomena is not forthcoming. However, it is possible to throw some light on the subject. Ammonium nitrate, NH_4NO_3, in its pure state, contains 20 per cent more oxygen than is required for its complete combustion—that is, to oxidize the hydrogen to water, evolving nitrogen as the gaseous element. The introduction of a material containing carbon, such as petrolatum or TNT, permits the formation of another gas or gases, carbon monoxide or carbon dioxide. It seems reasonable to say, judging from the evidence presented, either that carbon monoxide or dioxide is more easily formed by the action of heat than is free oxygen or that its disruptive effect is greater. This is a problem of chemistry, gas volumes, specific heats and expansion which need not be further elaborated.

This principle does not apply to all explosives. Some compounds are so loosely combined that their explosive decomposition is easily accomplished. However, other compounds rich in oxygen, but containing no carbon, exhibit this same behavior. Sodium nitrate and ammonium perchlorate are examples. These statements do not explain why petrolatum caused more fragmentation than TNT. It has been mentioned that the method of incorporation may have had some effect. The principle involved is of more importance. It is used in liquid oxygen explosives. Liquid oxygen is always absorbed in a carbonaceous material to make the explosive cartridge. The explosion of coal dust mixed with air or methane involves this principle.

This brief explanation by no means aims to be a complete discussion of the subject. It is conceivable that if enough heat be applied either by direct heat, or the heat from a detonator, or the heat caused by the compression of air from a violent concussion, to pure ammonium nitrate, the liberation of oxygen and nitrogen, suddenly expanding, would cause a violent disruptive effect and that this could be propagated through a mass of the material. However, this would ordinarily require a considerable stretch of the imagination.

Any contribution that these results make to the subject of the explosibility of ammonium nitrate and more especially to that phase of the subject which deals with accidental explosions must lie in the direction of preventive and safety measures. Ammonium nitrate in its pure state can hardly be considered as an explosive. However, in its manufacture, where it is subjected to some heat and confinement, it should be treated with due care and respect. Precautions should be taken that it be kept free from organic or carbonaceous materials and that heat and confinement be kept at a minimum.

It might be mentioned that during the World War the Atlas Powder Co. successfully and safely manufactured a very large percentage of the ammonium nitrate required by our military program.

The writer is indebted to R. L. Hill, director of this laboratory, for helpful suggestions and criticism.

Equipment News

From Maker and User

Metallographic Equipment

A simplified metallographic equipment for general routine inspections has been placed on the market by the Bausch & Lomb Optical Co., of Rochester, N. Y. Such inspections seldom if ever require magnifications above 200 diameters, and hence do not require the expensive equipment that is so necessary in research outfits.

This simplified equipment is a very compact unit, as shown in the accompanying photograph, with all of the parts mounted on one base, and with the light scope, camera and special ribbon filament illuminant. It is said to be easy to operate, easily portable and especially suited for low power work. It gives magnifications varying from 64 to 210.

Continuous Oil Chiller

James Moore, superintending engineer of the Burmah Oil Co., Ltd.'s refineries, has designed a novel oil cooling machine for which are claimed several advantages over equipment usually employed in paraffin extraction plants. It is of continuous operation, extremely compact and the usual twelve-cell unit such as is shown in Fig. 1 has the remarkable capacity of 1,500 gal. of heavy oil and paraffin per hour.

The main body of the Moore-Burmah oil cooler consists of a vertical series of shallow circular cooling cells, supported on a frame that also carries the housing for a worm and worm wheel drive and a step bearing to support a vertical shaft passing centrally through the cells and driving a scraper arm in the oil chamber of each cell. Each of the cooling cells comprises two chambers, upper and lower, the upper chamber being closed by the bottom of the next higher cell. The oil to be cooled flows through the upper chambers only in series from top to bottom. The cooling brine flows counter-current, through the lower chambers only, from bottom to top of the machine. Some of the top cells may be used as a heat exchanger if desired—the cold filtered oil being pumped through the brine cells in place of the brine, with consequent saving of refrigeration.

Simplified Metallographic Equipment

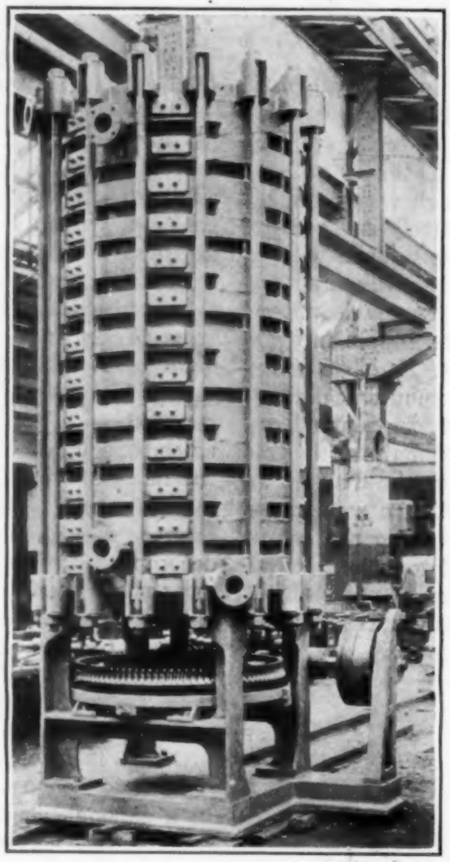


Fig. 1—A Twelve-Unit Oil Chiller Capable of Handling 1,500 Gal. of Heavy Oil and Paraffin Per Hour

The interior surfaces of the oil chambers are machined with a smooth finish, for it is to these surfaces that the paraffin (or other wax in case an animal or vegetable oil is being chilled) adheres as it crystallizes. This wax is scraped off continuously as it forms by knife-edged blades fitted to top, bottom and ends of a double-ended arm, keyed to the central shaft.

The capacity of the cooler may be varied between wide limits merely by changing the number of cooling cells, which are of unit construction and are bound together by vertical tie-bolts. One twelve-unit machine has cooled as much as 1,500 gal. per hour, but the makers of the equipment point out that this cannot be taken as a general basis of calculation, since capacity depends to a very large extent on the quality of the oil to be cooled and the percentage of paraffin or stearine to be extracted. The Moore-Burmah cooler is made by A. F. Craig & Co., Ltd., with London office at 12 Old Jewry Chambers, E. C. 2.

Further Developments in Rubber-Lined Acid Tanks

On March 24 last an article published in this department described the development of rubber-lined tank cars for the transportation, and stationary tanks for the storage of acids such as hydrochloric, sulphuric, phosphoric and tannic. This equipment and the method of manufacturing it were developed by the Miller Rubber Co., Akron, Ohio. Since that time this concern has made other developments along the same line that are of interest.

To meet the demand for a container for handling acids in less than carload lots, this company has developed a 50-gal. rubber-lined drum. The lining of this drum is of the same type as that used in the tank cars previously described. It is made of a rubber having the corrosion-resisting qualities of untreated rubber, but vulcanized in place according to the special method devised by the Miller Rubber Co.

It is claimed that there is no trouble of lack of adhesion between the rubber and the metal for the lining is not

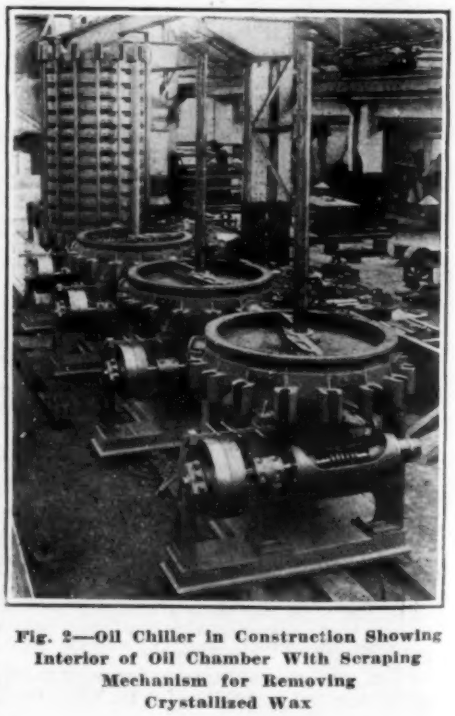


Fig. 2—Oil Chiller in Construction Showing Interior of Oil Chamber With Scraping Mechanism for Removing Crystallized Wax

simply cemented on, it is actually vulcanized to the metal. It has all the acid-resisting qualities of the uncured lining, but lacks the fragility of such lining. Where the unvulcanized lining would have a tensile strength of not more than 10 lb. per sq.in., this lining has a tensile strength of over 3,000 lb. per sq.in. It is claimed to be free from the defects of an unvulcanized lining also, in that it is relatively unaffected by temperature; it neither has a tendency to soften in summer heat nor to get hard and brittle in zero weather. There are no seams or defects as in the fabricated lining; it is made up of many plies and when finished is absolutely seamless. Since it is soft rubber, it has none of the troubles that have caused the failure of the hard rubber lining. So far as the aging qualities of this product are concerned, after 4 years the quality of the stock is just as good as when first applied. A container lined by this process is said to be permanently acid proof.

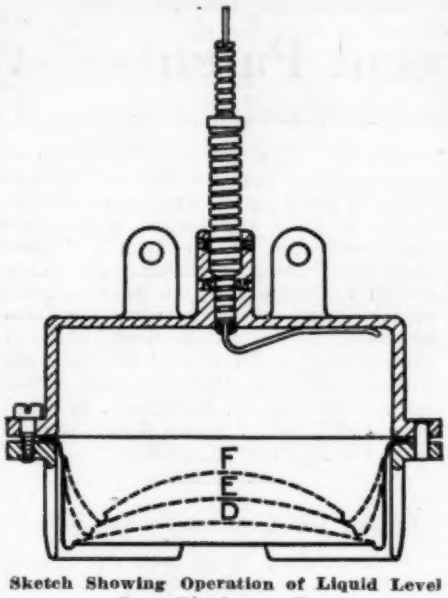
This lining process can be applied to any wooden or metal apparatus in which it is desired to perform chemical reactions in hydrochloric or dilute sulphuric acid and other solutions that must ordinarily be handled in enameled, iron or stoneware apparatus. This material, on account of its relative cheapness and adaptability, should replace glass and stoneware for many purposes. Sudden shocks or jars do not harm the lining. Metal apparatus can be bent or dented without injury to the rubber. Freezing solutions that often chip and break enamel and stoneware due to rapid and uneven expansion and contraction have no effect on this rubber. The rubber lining simply adjusts itself to any change that takes place in the walls of the lined vessel.

The peculiar properties of rubber that render it impervious to many corrosive liquids, together with its pliability in the unvulcanized state, which means that it can be formed into any shape, renders it particularly desirable for these purposes. The compounds used have been selected as the most desirable of the large number that were tested. These compounds when vulcanized, together with the ingenious method of application, insure a durable leak-proof lining that will not separate from the walls of the vessel to which it is applied.

Measuring Liquid Level

Indicating and recording instruments for registering the level of the liquid in a tank, reservoir, stream or other liquid container have been known for some years. In spite of this fact, one still sees this function performed, in most cases, by the well-known but none too efficient home-made brand of telltale. It is with particular interest, then, that one notes the complete line of liquid level gages made and marketed by the Foxboro Co., Inc., Foxboro, Mass.

This line comprises both indicating and recording instruments. The recorders are made in two types—those of the bronze diaphragm tube type for



Sketch Showing Operation of Liquid Level Gage Diaphragm Box

any pressure up to and including 30 ft. water for the 8-in. dial, 40 ft. water for the 10-in. dial and 60 ft. water for the 12-in. dial; while the bronze helical tube type has ranges for 8-in. dial from 40 ft. to 300 ft., 10-in. dial from 50 ft. to 300 ft., and 12-in. dial from 80 ft. to 300 ft. Indicating liquid level gages are also made in three sizes: 8 in., 10 in. and 12 in., and in two types: diaphragm tube type for pressures up to 60 ft. of water and Bourdon tube type for higher ranges.

These instruments consist of a recording or indicating instrument (which is of the familiar Foxboro pressure gage design), a connecting tube of sufficient length so that the dial is located where desired, and the diaphragm box, located in the tank or container that is to be measured. This diaphragm box is the essential feature of the level gage. It is shown in the accompanying sketch.

This box is made of two bronze castings, *A* and *B*. Between them is inserted the rubber diaphragm *C*, made of different grades of rubber, depending upon the application. In cases where the liquid to be measured would be injurious to the rubber diaphragm or to the castings *A* and *B*, suitable materials are substituted for those mentioned above, but the principle of operation here described remains the same in any case.

The two sections of the box are securely held together by a series of large screws *H*. To facilitate the accurate insertion of the rubber diaphragm *C* and to locate these sections properly there are two dowel pins *I*, diametrically opposite each other.

The connection from the diaphragm box to the gage is made by means of the capillary tube *J* reinforced by flexible bronze protection *K*, which is also reinforced by an extra sheathing *G*. The form of the rubber diaphragm *C* is such that temperature errors are claimed to be eliminated.

When the diaphragm box is submerged in a liquid, the rubber diaphragm changes its position, as shown by *D*, *E* and *F*, depending upon the height of liquid. This change in position compresses the air contained in the upper section of the box, and the pressure thus created is transmitted through the capillary tube *J* to the actuating element of the indicating or recording instrument.

The ratio of air volumes in the sealed section of the box, in the capillary tube and in the actuating element of the measuring instrument, together with the form of the diaphragm, is such that it is said an instrument can be installed 1,000 ft. from the zone of measurement with a negligible temperature correction.

Grease Cup

A grease cup is a small matter in a plant or factory, but it can be a nuisance and a cause of expense far out of proportion to the cost of the cup. Recognizing this, the Link-Belt Co., of Indianapolis, has developed a new top for its regular compression grease cup. This top is hexagonal in shape, which provides not only a good grip for the hand but one for a wrench. Cold, stiff grease makes a compression cup very hard to turn, and a pipe wrench is not always accessible. The hexagonal shape provides grip spaces for the ordinary wrench. Also, this cup is provided with a raised slot so that the cup can be turned with a screw driver, when it is so located that it is inconvenient for the hand or wrench. Made of malleable iron, the new cup, known as the Hex-Top grease cup, is said to be absolute grease tight.

Manufacturers' Latest Publications

Roller-Smith Co., 233 Broadway, New York City.—Three bulletins: No. 160, a new catalog of type GSA alternating current portable instruments; No. 240, a catalog of precision torsion balances; No. 560, a catalog of type P and type E safety circuit breakers.

Sanford Riley Stoker Co., Worcester, Mass.—Catalog 83. A catalog describing the latest development in underfeed stokers, called the "Lateral Retort" Stoker.

The Cambridge & Paul Instrument Co. of America, Inc., Grand Central Terminal, New York City.—No. 152. A descriptive pamphlet dealing with "Cambridge" draft and pressure gages, both indicating and recording types.

Taber Pump Co., Buffalo, N. Y.—A data sheet for single suction open impeller type centrifugal pumps with double pedestal bearings or extra deep stuffing boxes in sizes from 1 in. to 10 in.

The Niagara Falls Power Co., and Niagara, Lockport & Ontario Power Co., Niagara Falls, N. Y.—A splendidly illustrated booklet giving the story—past, present and future—of the development of hydro-electric power at Niagara Falls.

Euclid Crane & Hoist Co., Euclid, Ohio—A catalog entitled "Euclid Utility," which describes and illustrates the Euclid line of cranes and hoists and various uses of this equipment over a wide range of industries.

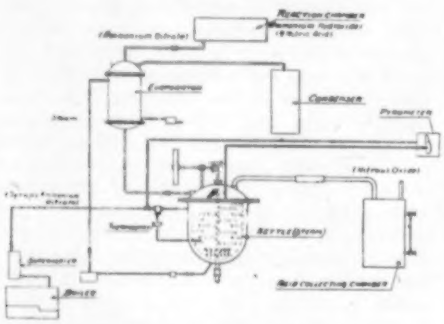
Crouse-Hinds Co., Syracuse, N.Y.—Folder 13. A folder describing the various types of connectors made by this concern for use in connecting rigid conduit, flexible conduit or armored cable to a drive motor or similar device in an industrial plant.

Justinian Caire Co., San Francisco, Calif. —An illustrated catalog has recently been issued by this firm, giving descriptions and prices of assayers' supplies, chemical equipment and reagents, mill supplies and glassware. Specialties handled include Calkins' assay-office appliances, zinc shavings, resistance glassware, cyanide of potassium and sodium, one-stamp mills, pure acids and chemicals, Hoskins' electric furnaces, oil-testing apparatus, hydrometers and thermometers.

Review of Recent Patents

Nitrous Oxide

It is customary in the manufacture of nitrous oxide to treat ammonium hydroxide with nitric acid to produce ammonium nitrate and water. The products of this reaction are then run into an evaporating tank where the water is evaporated, leaving the solid ammonium nitrate. This solid product is cooled and moved from the evaporating tank and broken into particles of small size, after which it is charged into a suitable kettle and strongly heated to break up the ammonium nitrate with the evolution of nitrous oxide gas. This method, which is the standard method of producing nitrous



Nitrous Oxide Manufacture

oxide, involves a considerable delay because of the necessity for cooling, disintegrating and then again heating the ammonium nitrate.

In order to overcome this disadvantage, Max P. Miller and Maurice F. Roche, of Cleveland, Ohio, have developed the method shown in the accompanying illustration. The solution resulting from the reaction of the ammonium hydroxide and nitric acid is evaporated to a syrupy consistency and this syrup of ammonium nitrate is run directly into a steam-jacketed kettle. By using superheated steam a temperature of about 225 deg. C. is maintained, and the ammonium nitrate decomposes with the formation of nitrous oxide which is washed and purified in the usual manner. Temperature-controlling instruments are provided on the steam-jacketed kettle. (1,499,544, assigned to Lennox Chemical Co., Cleveland, Ohio, July 1, 1924.)

Edible Fish Flour

Stanley Hiller, of San Jose, Calif., has devised a process which makes it possible to separate the bone from fish meal. The large amount of bone usually present in such meals has rendered them unfit for human food although they have been fed to cattle and except for the bone contain materials of considerable food value.

The fish are cleaned, cut into small pieces, cooked and pressed to remove oil. The cake is dried and fed while still hot to a masticator similar in type to that made by the International Harvester Co. This consists of a series of rotating dogs that act on the dry material to break up the dry flesh and separate it from the bone. After this treatment most of the flesh will pass through a 20-mesh shaking or rotary screen while most of the bone remains on the screen. Air separation may also be used. The sifted flesh is then ground to a flour. (1,501,775, assigned to Roy L. Daily, of San Francisco, Calif., R. R. Bellingall, of Oakland, Calif., and Stanley Hiller, of San Jose, Calif., July 15, 1924.)

Lining for Cement-Drying Kilns

In the rotary kilns used for drying crushed limestone in making cement, it has been the practice to bolt Z-bars to the side of the shell. This constitutes the lifter; no lining has ordinarily been used. These Z-bars have been made of rolled steel bolted to the outer shell, usually about ½ in. thick and 8 in. in width. After about a year and a half continuous run, the material wears the Z-bars away at the base and cuts them off. The material also wears the outer shell, and it is necessary to cut out a piece of the shell and replace it with a new piece of sheet steel. The time required for this type of repair is often as high as five days, which results in seriously impairing the operation of the cement mill.

After the shell has been repaired as

Liner for Kilns

above, in a few months it will start to wear again in between the Z-bars. In the course of time, say five years, whole sections of the kiln have to be taken off and replaced with new, requiring two or three weeks to manufacture the sections and effect the repair.

John L. Lundberg, of Alpena, Mich., uses high-grade semi-steel castings with inwardly projecting lifter webs having reinforcing webs. These are spaced as desired and bolted to the shell. The space between is filled with plain liner plates. Both types of plates are cast with recesses on the side toward the shell so that they are considerably lighter than a solid liner and yet retain its strength. The lifters are cast in relatively short sections, whereas the older Z-bars were often 100 ft. in length. Replacements are consequently made in much shorter time—3 to 5 hr. (1,501,566, assigned to Huron Industries, Inc., Alpena, Mich., July 15, 1924.)

Phosphorus in Lead-Coating Baths

The presence of phosphorus in molten metal baths for forming protective coatings on iron, steel or other metals is desirable because it increases the adherence of the coating. Introduction of phosphorus as phosphor-tin has been proposed but in many cases tin is not wanted in the coating.

Edwin R. Millring, of Belleville, N. J., finds that it is possible to prepare a phosphorus-lead alloy, which may be used to introduce the phosphorus when tin is objectionable. Lead and 1 to 5 per cent phosphorus are heated to 650 deg. C. for about 6 hr. in a sealed metal receptacle or bomb in the presence of an inert gas. The alloy may be added to the coating bath while still molten or it may be formed into ingots and these melted under the surface of the bath. (1,501,356, assigned to American Machine & Foundry Co., July 15, 1924.)

Para-aminophenol by Electrolytic Reduction

Charles J. Thatcher, of New York, N. Y., has described a method for producing para-aminophenol and its salts by electrolytic reduction of nitrobenzol in sulphuric acid.

Using a diaphragm cell with carbon cathode and lead anode, a charge of 14 lb. redistilled nitrobenzol and 125 lb. 78 per cent sulphuric acid is electrolyzed with a current density of 3 amp. per sq.dm. and a voltage drop of 4 v. per cell. In a properly proportioned cell this current will maintain the charge at a temperature between 70 and 80 deg. C. About 6,000 amp.-hr. are required to effect the reduction. When complete, the charge is withdrawn and cooled slowly. The crystals of crude para-aminophenol sulphate that crystallize out are filtered off, dissolved in water and excess acid neutralized with milk of lime. Evaporation of the filtrate from the calcium sulphate sludge yields crystals of para-aminophenol sulphate. If a white product is desired, the evaporated liquor should be treated while hot with animal charcoal. Mother liquors are recrystallized until the product becomes impure. The liquor is then neutralized with calcium carbonate to precipitate the base and this mixture added to the crude crystals before neutralization. (1,501,472, July 15, 1924.)

Purifying Brine for Electrolysis

Hugo H. Hanson and John T. Leecock, of Bangor, and Charles A. Blodgett, of Brewer, Maine, have modified the method of purifying brine for use in chlorine-caustic cells, as follows:

In washing the salt crystals after drawing off caustic liquor, a less complete removal of caustic than usual is practiced so that the reclaimed brine is more alkaline than is customary. When this is added to fresh brine, magnesium is precipitated as hydroxide.

Carbon dioxide (cleaned flue gas) is then passed into the brine, precipitating calcium carbonate. After filtering, chlorine is used instead of hydrochloric acid to effect neutralization. An advantage is that ferrous iron is oxidized to the less soluble ferric state so that it may be filtered out, thus removing an agent that tends progressively to clog the electrolytic cell diaphragms.

It is pointed out that omitting the last stages of washing leaves the caustic solution more concentrated and less contaminated. The cost of the residual caustic is less than the price of equivalent soda ash. (1,500,126, July 8, 1924, assigned to Eastern Manufacturing Co., Boston, Mass.)

U. S. Patents Issued July 29, 1924

Device for Controlling the Flow of Gases. Thomas R. Blanchard, Minneapolis, Minn., assignor, by mesne assignments, to The Airgas Burner Company, Minneapolis, Minn.—1,502,654.

Apparatus for Treating Pulps. Walter O. Borcherdt, Austinville, Va., assignor to The New Jersey Zinc Company, New York, N. Y.—1,502,657.

Centrifugal Dryer. Harry C. Law, Hastings upon Hudson, N. Y.—1,502,677.

Manufacture of Paper and Other Fibrous Compositions. Philip Schidrowitz, London, England, assignor to Vultex Limited, St. Helier, Jersey, Channel Islands.—1,502,686.

Indicator for Mills. August Sundh, Hastings upon Hudson, N. Y., and William Websterman, Detroit, Mich.—1,502,695.

Cushioning Device for Liquid Conveyed Under Pressure. Friedrich Munzinger, Berlin, Germany, assignor to the Firm Allgemeine Elektricitats-Gesellschaft, Berlin, Germany.—1,502,739.

Furnace Arch. Michael Liptak, St. Paul, Minn., assignor to Liptak Fire Brick Arch Co., Minneapolis, Minn.—1,502,790.

Process for Reducing Fused Slag to Granular Form. Martial Maguet, Maxeville, France.—1,502,793.

Process for the Production of Nitroso-Meta-Cresol and its Application to the Separation of Meta-Cresol and Para-Cresol. Jacob Ehrlich, Belleville, N. J., assignor to Verona Chemical Co., North Newark, N. J.—1,502,849.

Air-Heating Means. Philip Little, Jr., Minneapolis, Minn., assignor to The Strong Scott Manufacturing Company, Minneapolis, Minn.—1,502,858.

Process for the Utilization of Vegetable Materials and Manufacture of Gas Adsorbent and Decolorizing Carbons. Oscar L. Barnebey, Detroit, Mich.—1,502,896.

Apparatus for Separating and Recovering Gases. Oscar L. Barnebey, Columbus, Ohio.—1,502,897.

Evaporating Apparatus. William G. Doern, Milwaukee, Wis.—1,502,911.

Process of Oxidizing Dibenzyl. Henry R. Curme, Clendenin, W. Va., assignor to Carbide and Carbon Chemicals Corporation. —1,502,941.

Process of Making Colloidal Bodies. Carleton Ellis, Montclair, N. J.—1,502,945.

Insecticide. Paul R. Jones, Porterville, Calif., assignor to Balfour, Guthrie & Company, San Francisco, Calif.—1,502,956.

Process of Making Sodium Sulphide. Earl Burnard Alvord, Cleveland, Ohio, assignor to The Grasselli Chemical Company, Cleveland, Ohio.—1,503,013.

New Azodyestuffs. Josef Haller, Wiesdorf, near Cologne-on-the-Rhine, Germany, assignor to Farbenfabriken vorm. Friedr. Bayer and Co., Leverkusen, near Cologne, Germany.—1,503,044.

Shale-Distillation Apparatus. Robert M. Catlin, Franklin, N. J., assignor to Catlin Shale Products Company, Wilmington, Del. —1,503,093.

Process for Vulcanizing Rubber with Condensation Products of Ammonia and Aldehydes as Accelerators. Sidney M. Cadwell, Leonia, N. J.—1,503,113.

Process for the Production of a Filtration Accelerator. Charles F. Ritchie, Lompoc, Calif., assignor to The Celite Company, Los Angeles, Calif.—1,503,133.

Process of Producing Paper Pulp and Apparatus Therefor. Charles W. Shartle, Middletown, Ohio, assignor to The Shartle Brothers Machine Company, Middletown, Ohio.—1,503,138.

Intermediate Product and Process for the Manufacture of the Same. Fritz Straub, Basel, and Hermann Schneider, Riehen, near Basel, Switzerland, assignors to The Society of Chemical Industry in Basle, Basel, Switzerland.—1,503,172.

Triarylmethane Dye. Max Weiler, Elberfeld, Germany, assignor to Farbenfabriken vorm. Friedr. Bayer and Co., Leverkusen, near Cologne-on-the-Rhine, Germany.—1,503,177.

Rotary Kiln. Johan S. Fasting, Valby, near Copenhagen, Denmark, assignor to F. L. Smidth & Co., New York, N. Y.—1,503,186.

Rotary Cooler for Cement Clinkers, etc. Povl T. Lindhard, Brooklyn, N. Y., assignor to F. L. Smidth & Co., New York.—1,503 193.

Mordant Dyestuffs and Process of Making Same. Theodore Lombard, Basel, Switzerland, assignor to the Firm, Durand & Huguenin S. A., Basel, Switzerland.—1,503,194.

Method of Preventing the Natural Deterioration of Bagasse Fibers. Treadway B. Munroe, New Orleans, La., assignor to C. F. Dahlberg, Minneapolis, Minn.—1,503,202.

Process of Treating Solutions of Metals. Louis F. Clark, Potrerillos, Chile.—1,503,229.

Shale Retort. Daniel H. Francis, Grand Junction, Colo.—1,503,234.

Paper-Making Apparatus. Charles G. Robinson, Buffalo, N. Y., assignor, by mesne assignments, to The Beaver Products Company, Inc.—1,503,246.

Process for the Production of Concentrated Nitric Acid. Einar Bergve, Skoien, near Christiania, Norway, assignor to Norsk Hydro-Elektrisk Kvaelstofaktieselskab, Christiania, Norway.—1,503,259.

Wood Grinder. Paul Priem, Heidenheim-on-the-Brenz, Germany, assignor to American Voith Contact Company, Inc., New York, N. Y.—1,503,289.

These patents have been selected from the latest available issue of the "Official Gazette" of the United States Patent Office because they appear to have pertinent interest for "Chem. & Met." readers. They will be studied later by "Chem. & Met.'s" staff, and those which, in our judgment, are most worthy, will be published in abstract.

Complete specifications of any United States patent may be obtained by remitting 10c. to the Commissioner of Patents, Washington, D. C.

Gas Regulator. Thomas J. Cleary and George F. Quinn, Pittsburgh, Pa.; Irene Cleary Treacy, administratrix of said Thomas J. Cleary, deceased.—1,503,301.

Process of Producing Mixtures of Nitrogen and Hydrogen. Birger Fjeld Halvorsen, Christiania, Norway, assignor to Norsk Hydro-Elektrisk Kvaelstofaktieselskab, Christiania, Norway.—1,503,319.

Apparatus for Mixing, Grinding, Refining, or Treating Liquid Material, Such as Liquid Chocolate. John Caldwell Robins, Birmingham, England.—1,503,379.

Apparatus for Transmitting Heat From One Liquid To Another. Iknar Morterud, Christiania, Norway.—1,503,428.

Process of Accelerating the Vulvanization of Natural or Artificial India Rubber or Rubberlike Substances. William Fraser Russell, Norwalk, Conn., assignor to The Norwalk Tire and Rubber Company, Norwalk, Conn.—1,503,429.

Method of Producing Crinkled Paper and Product Obtained Thereby. Eberhard Klepper, Crimmitschau, Germany, assignor, by direct and mesne assignments, of three-eighths to Herman Stern, New York, N. Y., and thirty-seven and one-half per cent to John F. Hayes, Washington, D. C., and twenty-five per cent to Samuel B. Sutphin, William F. Ross, and Ralph W. Ross.—1,503,451.

Kiln. Enoch P. Stevens, Morgan Park, Chicago, Ill.; Mary Ann Stevens, executrix of said Enoch P. Stevens, deceased.—1,503,455.

Book Review

Pulp and Paper

MANUFACTURE OF PULP AND PAPER. A series of 5 textbooks on modern pulp and paper mill practice prepared under the Joint Executive Committee on Vocational Education representing the pulp and paper industry of the United States and Canada. Vol. I by J. J. Clark contains 441 pages and includes sections devoted to Arithmetic, Elementary Applied Mechanics, Reading of Drawings and the Elements of Physics. Vol. II by J. J. Clark and T. L. Crossley contains 525 pages and includes sections devoted to Mechanics and Hydraulics, Elements of Electricity and Elements of Chemistry. Vol. III on the Preparation and Treatment of Wood Pulp contains 691 pages and includes in its list of authors the following: H. N. Lee, J. Newell Stephenson, R. W. Hovey, S. Roy Turner, Bjarne Johnsen, Arthur B. Larchar, Karl M. Thorsen, J. O. Mason, T. E. Kloss, H. H. Hanson, Max Cline and H. J. Buncke. Vol. IV contains sections devoted to Rags, Waste Papers, Beating, Loading and Sizing, Coloring and Paper Machines. This volume of 527 pages includes in its list of authors the following: E. C. Tucker, Ed. T. A. Coughlin, Arthur B. Green, Ross Campbell, J. W. Brassington, Judson A. DeCew, C. J. West, James Beveridge and others. Vol. V, concludes the discussion of paper manufacture, begun in Vol. IV and will be published shortly. McGraw-Hill Book Co., New York. Price, $5 per volume.

Another gap in the literature of chemical engineering has been bridged by the publication of this series of texts of which the last three deal adequately with modern methods employed in the production of pulp and the fabrication of paper. The Technical Associations of these industries both in the United States and Canada have done a splendid piece of work in their co-operative efforts that have made these books possible. The reader must recognize that the authors of the various sections speak with authority—and in many cases it will be found that the information contained has not existed previously either in book or in other form.

The entire series is to include five volumes although at present the last (Vol. 5) is not off the press. Volumes I and II are not of especial interest to the trained engineer although for those workers in the industry who are anxious to understand the technology involved but who lack grounding in the essentials of mathematics, drafting, physics, electricity and chemistry, they will prove invaluable. The material is so presented that the books of the entire series serve equally well as handbook or as texts for study.

Vol. III is perhaps the outstanding work in the group for the chemical engineer. Pulp production—groundwood, sulphite, soda and kraft are each discussed at length while the wood preparation, refining and bleaching operations, more or less common to all, are treated separately. Considerably more space is devoted to the kraft pulp proc-

ess than to the older ones—a particularly sensible arrangement since almost nothing has previously existed in the literature on this subject. In this volume as in the others the pages of each section begin with 1 and carry through. This makes for a rather clumsy index that might well be done away with in subsequent editions.

Vol. IV takes up the handling of pulp where Vol. III left off and includes also the processing of other paper making fibers such as those from rags, hemp, jute, esparto and straw. One section is devoted entirely to the treatment of waste papers for the production of deinked stock. Problems incident to beating and refining of pulp are discussed in a chapter of 80 pages. Here again a fine sense of proportion is demonstrated since accurate information on this phase of manufacture has been difficult to obtain in the past. In connection with this section a complete bibliography of references is included, compiled by C. J. West.

The business of paper making has long been considered an art carried on from generation to generation by practical men. In no phase of manufacture has this been more true than in connection with the loading, sizing and coloring of the product. Here dark mystery still shrouds the essential facts in many plants—even the skilled worker carries on more or less blindly as far as "the reason why" is concerned. The periodical literature of the past few years has indeed contained many excellent short articles on various phases of this art but as far as is known no compilation of this work has been made. Hence the two chapters that are devoted to this phase of manufacture are of unusual value. Student and foreman should find these sections equally valuable, either as a reference or as a practical working guide. The tables of properties of various materials that are included as well as the scientific background that is supplied for understanding the reactions involved are of very decided merit.

Naturally no treatise on paper making would be complete without devoting space to the machines on which the finished sheet is formed. Beginning with an outline of the considerations involved in machine room design, auxiliary equipment, the fourdrinier, the press parts, smoothing rolls and driers, calenders and slitters are taken up in the order named. In this volume 210 pages are devoted to this section alone. In keeping with the general plan followed throughout, brief historical outlines, a discussion of operating difficulties and a comprehensive questionnaire are included. This latter is aimed to be primarily of service to those students who are using the books as texts. As a matter of fact, the series is already being used with splendid results, in home study courses conducted by schools both in the United States and Canada.

In having produced texts of this sort, the Technical Association of the Pulp and Paper Industry deserves commendation. Every evidence indicates that individual members have given their best in the light of their experience toward making the subject matter the last word in authority on the many topics treated. No one directly engaged in the production of either pulp or paper can well afford to be without Vol. 3 and 4. Furtherfore, any engineer desirous of including in his library the best in the technical literature of these industries will do well to investigate these most excellent books. HAROLD J. PAYNE.

Books Received

Solubility

SOLUBILITY. By *Joel H. Hildebrand*, Ph.D., professor of chemistry, University of California. 206 pages, illustrated. Chemical Catalog Co., New York. Price, $3.

In spite of the immense practical importance of solubility, our knowledge of its laws is still far from the point where we can predict with certainty the result to be expected in any given case. While a large amount of work has been done on the subject, it has been scattered and chemical engineers as well as chemists will welcome Prof. Hildebrand's authoritative correlation of the known facts. The book is divided into two main parts, Chapters I to X being devoted chiefly to the presentation of the various aspects of a comprehensive theory of solubility, Chapters XI to XVIII chiefly to the application of the theories to existing data.

Elements of Group I

A TEXT-BOOK OF INORGANIC CHEMISTRY. Edited by *J. Newton Friend*, Ph.D. Vol. II, The Alkali Metals and Their Congeners, by *A. Jamieson Walker*, Ph.D. 379 pages, illustrated. Charles Griffin & Co., London: J. B. Lippincott Co., Philadelphia.

Group I of the periodic system is covered in this volume. Hydrogen, lithium, sodium, potassium, rubidium, cæsium, copper, silver and gold with their compounds are treated in detail. There is also a chapter on ammonium compounds, as the ammonium radical is so closely related in properties to the alkali metals that its inclusion was found essential.

Clouds and Smokes

CLOUDS AND SMOKES. By *William E. Gibbs*, D. Sc., chief chemist to the Salt Union, Ltd., Liverpool. Foreword by *Sir Oliver Lodge*, F.R.S. 240 pages, 31 illustrations. P. Blakiston's Son & Co., Philadelphia. Price, $3.

Highly disperse systems in which the dispersion medium is a gas are conveniently designated aerosols by the author. Part I of the book is devoted to a detailed consideration of the methods by which aerosols are formed, the general properties of such systems, the movements of the particles, the conditions that determine stability and the methods by which all these properties can be determined experimentally. In Part II, this information is considered in its direct relation to the phenomena of meteorology, the problem of dust explosions, the industrial treatment of fumes and dusty gases, the manufacture of substances in a finely divided condition and, finally, the use of smoke in warfare.

Readers' Views

Effects of Surface Film on Heat Transfer

To the Editor of Chem. & Met.:

SIR—In the article "Effects of Surface Film on Heat Transfer," p. 1,029, June 30, 1924, there is I believe another phase to consider other than the "thin film of nearly stagnant liquid on the surface of the metal." If we are evaporating water in a boiler or evaporator, there will first be deposited a thin film of metallic oxide, then, as evaporation proceeds, a thin layer of scale, and should there be a layer of stagnant liquid, it must be outside of both the metallic oxide and the scale.

In boiler practice, there is a coating of wet scale of varying thickness. It has a more or less porous structure and its water content may vary from 2 per cent close to the metal, to 25 per cent on the side of the scale in contact with the liquid or even 50 per cent or higher in scale in process of formation. Although the latter may not have coagulated to the extent that it cannot be washed off, it will retard the transmission of heat to a very considerable extent. Even though the film of stagnant liquid may be present, I believe that our problem lies more with the formation of the oxide and scale and their action in retarding the flow of heat into the liquid.

This action is evident in many other cases. In evaporating sugar a semi-glutinous mass forms on the condenser tubes. This deposit is not a good heat conductor and for that reason will retard the passage of heat to a greater extent even than boiler scale. As both these deposits contain 2 to 25 or more per cent of water, it may well be considered that these are the films of stagnant liquid referred to in the article.

If the metal were actually clean we might refer to the retardation as equivalent to 39,700 B.t.u. and design our condensers, evaporators or boilers for the passage of only 300 B.t.u., but after a few hours we will find that the 300 B.t.u. has dwindled down to about 10 B.t.u., and from experiments made possible, I am of the opinion that even this low figure is entirely too high and that after say ten hours of service it will be found that not over 2 B.t.u. will actually be delivered to the liquid to be evaporated out of the original 40,000 B.t.u.

As all of our industries rely in some way upon the amount of heat transferred through metals, this heat loss will be found to be one of the greatest losses in our commercial civilization and it will take many years of intense study before we will be able to conserve even a small portion of this great loss. C. G. WILLIAMS.

Davenport, Iowa.

News of the Industry

Summary of the Week

Interested parties given until close of business today, to file briefs relative to tariff status of refined sodium nitrate.

Advisory committee on industrial alcohol will meet Commissioner of Internal Revenue in Washington on August 14.

Three crews of experts of Tariff Commission have began work of investigating costs of producing vegetable oils.

German recovery of economic control of the Ruhr expected to affect American exports of chemicals.

Treasury Department issues seventh supplemental list of standards of strengths for dyes for appraisement purposes.

Silica producers adopt research program in order to broaden market for their products.

American Institute of Chemists forms Washington Chapter, discussing re-classification act with reference to government chemists.

Following incorporation under laws of New York State the Chemical Equipment Association has changed its name to Chemical Equipment Manufacturers.

Chemical Association Advocated To Hold Export Trade

While there is no disputing that the application of the Dawes' plan will increase the difficulties of American chemical manufacturers engaged in export trade, the situation is by no means hopeless, in the opinion of those who maintain close contact with the industry. In fact, one of the large chemical manufacturing interests is perfecting plans at this time to enter the export trade in a large way.

In some quarters, regret is being expressed that a chemical export association was not formed when the matter was first agitated. Some think it still could be undertaken to the advantage of the American industry. At any rate there is every evidence that the recovery by the Germans of economic control of the Ruhr and the rehabilitation of Germany's finances, will not mark the beginning of the American chemical industry's retirement from export trade.

There are some, however, who believe the opportunity of succeeding in the export field is just as good today as it has been at any time since the armistice. Germany now has no large stocks to dump and her prices have increased greatly. At the same time our industry has written off some of its war-time valuations of plant and other property and has made steady inroads into practically all of its costs. Moreover the world's capacity to purchase has increased greatly. In Latin America, the most important foreign field insofar as the American industry is concerned, the increase in purchasing power has been particularly marked during the last year owing to increased demand and price advances on practically all the tropical commodities. Since the war, German industry has had the advantage at least of low taxes. With the setting up of definite payments of reparation and the setting aside of sinking funds in connection with the foreign loan, German industry is going to be called upon to bear a heavy portion of the burden, which will tend to narrow further the differences between the costs of chemical production in that country and in this. Moreover Germany is going to increase her exports gradually. There will be no sudden burst of German goods upon the markets of the world.

Vegetable Oil Investigations Make Progress

Three crews of experts of the Tariff Commission have begun work in the South investigating costs of producing cottonseed oil and peanut oil in connection with the inquiry into these oils and soya bean oil and coconut oil under the flexible tariff, on application for a reduction in duties having been filed.

Plants in Texas and Oklahoma are being visited by M. G. Donk and V. A. Roberts, chemists, and Harry Newton and A. C. Fisher, accountants; plants in Louisiana, Arkansas, Mississippi, Alabama and Tennessee are being visited by F. W. McSparren and G. L. Barry, chemists, and Myron Grigg and Ray R. Merrill, accountants, while crushers in Georgia, the Carolinas and Virginia are veing visited by Frank Talbot and Benj. Weisbrok, chemists, and L. S. Baliff and W. I. Streett, accountants. Dexter North, of the Chemical Section, and S. I. Heacock, of the accounting staff, will start this week checking coconut oil refiners of the Atlantic seaboard and throughout the north.

Reorganization Plan for Magadi Soda Co., Ltd.

Advices from London state that plans have been drawn up for the reorganization of the Magadi Soda Co., Ltd. A new company is to be formed with capital stock of £830,000. One director is to be named by the governor of Kenya Colony, one by present trustees for the first debenture holders, and the remainder by Brunner, Mond & Co., Ltd. Provision is to be made for payment in full of certain creditors, such as the Government of Kenya Colony, Uganda Railway, etc. The total amount of these debts is not to be more than £20,000, and will be provided by the new company. Brunner, Mond & Co., Ltd., are to be allotted at par 100,000 ordinary shares, to be paid for in cash, and such preferred ordinary shares as are not taken up by the second preference shareholders. Brunner, Mond & Co., Ltd., will give guarantees to the satisfaction of the Official Receiver and the Colonial Government that the company will work the Magadi Soda Co.'s property to its full economic capacity. The scheme is subject to a lease being granted by the Colonial Office of the new company.

To Select New Chief Chemist for Chemical Warfare Service

Selection of a new chief chemist for the Chemical Warfare Service probably will be made this month. Gen. Amos A. Fries, the head of the Service, has referred the lists of chemists who have been suggested for the place to the Committee of the American Chemical Society in charge of co-operation with the Chemical Warfare Service. No announcement has been made as to the probable appointment.

News in Brief

Canadian Lignite Plant May Change Hands Again—Control of the lignite plant at Bienfait, Saskatchewan, is now in the hands of the Saskatchewan goverment, which is negotiating with one or two firms to take over the plant and operate it as a commercial utility, according to an announcement made by Hon. J. G. Gardiner, in charge of industries. Mr. Gardiner stated the federal government had relinquished its equity in the plant to the Saskatchewan government, providing the plant and equipment are used to complete the work as originally planned.

Herbert & Herbert Resume Production—The Herbert & Herbert Chemical Co., Perth Amboy, N. J., is arranging for the early resumption of production at its local plant, which has been closed since June by order of the Court of Chancery, owing to obnoxious odors and fumes. Equipment has been installed to eliminate the objection, and a series of tests will be carried out at once. Herbert Phillips and Herbert Gillis head the company.

Bark for Fuel Studied—The Northern Foundry and Machine Co. of Sault Ste. Marie, Ont., has been experimenting in the use of bark for fuel purposes. The bark is being treated by a new machine which has been manufactured at the company's foundry. The machine was recently given a thorough test in the presence of H. J. Bunche, chief engineer of the Abitibi Co., with the result that he made the first purchase. The Spanish River Pulp and Paper Mills, Ltd., are also showing a great interest in the progress of the work.

June Petroleum Production Was Lower — The petroleum refineries of the United States showed in June, a falling off in the production of gasoline which had been steadily increasing through March, April, and May. The production of gasoline during June was 737,080,701 gallons, as compared with the high-water mark of 754,773,232 gallons established in the previous month. This represents a daily decrease of 598,192 gallons, or 2.4 per cent. However, the output of gasoline for June shows an increase of 16 per cent in production over June of the previous year.

French Become Interested in Bauxite—An increasing interest in bauxite developments is shown by French manufacturers, because of their confidence that cast cement or "Ciment fondu," will soon be produced at a price allowing its wide industrial use. In making this product, bauxite is necessary, and its production will rapidly increase if, as aluminum interests believe, its manufacture by the rotary furnace can be perfected—an accomplishment which would greatly reduce the price—and put it on a basis with the current brands of cement. The new product, it is claimed, has a wide field of utility, because it remains unchanged in the presence of waters charged with acids and magnesia.

Changes Occur in Canadian Paint Firms—International Paints (Canada) Limited, has been granted a Dominion charter to purchase the goodwill and all assets of the Canadian branch of the business of manufacturers and merchants of paints heretofore carried on by the International Paint and Compositions Co., Ltd., incorporated in Great Britain. The company is capitalized at $100,000 and headquarters will be in Vancouver.

Potters Refused Wage Increase—The United States Potters' Association has refused the demand of the National Brotherhood of Operative Potters for wage advances varying from 10 to 15 per cent over the present schedule, effective Oct. 1. Members of the association are agreeable to a renewal of the present agreement under the same wage terms for another 2-year terms. A conference between the employers and employees will be held at Atlantic City, Aug. 12.

Campbell Soup to Start Manufacture in Ontario.—The Campbell Soup Co. of Camden, N. J., plans to establish a factory in Essex County, Ontario, either at Kingsville or Leamington.

Another Fertilizer Plant Established in South—The Redd Chemical & Nitrate Co., with a capital stock of $400,000, have commenced work on a manufacturing plant near Inglenook, a suburb of Birmingham, Ala., and it is announced that this plant will be completed and in operation by October 1. Will P. Redd is president and general manager; W. H. Kettig is vice-president, and C. Z. Davis is secretary and treasurer. This plant will manufacture a high-grade of fertilizer, adopted to the soils of Alabama and adjoining states.

Jersey Glass Plants Active During Summer Season

For the first time in the history of the glass industry at Glasstown, Millville and vicinity, N. J., a number of the plants are continuing production in August, and expect to maintain throughout the month. Until a year or two ago, it had become the general practice to close all plants during July and August, these being considered as the regular vacation periods of operatives. This year finds the Whitall-Tatum Co., operating 2 factories at its South Millville plant, together with a continuous tank at the Glasstown works; the T. C. Wheaton Co., with one furnace in service to continue indefinitely. The Kimpton-Kaupt Co. is likewise maintaining one furnace at its plant through the present month, while the Millville Bottle Works have a one pot furnace running, probably to be closed down in a fortnight for a short period.

Chemical Equipment Association Changes Name

The Chemical Equipment Association announces the change of name of the organization to Association of Chemical Equipment Manufacturers.

The Association recently incorporated under the Membership Corporations Law of New York State as a non-profit-operating membership corporation. Most of the active trade associations in the country are similarly incorporated.

A confusion in corporate names necessitated the change of name of the Association. The former name will continue to be used in an informal way temporarily.

Metallurgical Research Planned at Carnegie Institute

Three important studies in metallurgical research will be undertaken in Pittsburgh during the coming year by the Carnegie Institute of Technology in co-operation with the U. S. Bureau of Mines. The problems, which were selected by an advisory board of steel manufacturers and metallurgical engineers will be investigated as a result of the recent arrangement developed by the Institute and the Bureau of Mines under which definite programs of research studies are to be made each year for the benefit of the metal industries.

To carry on the work in 1924-1925 four college graduates have already been appointed to Research Fellowships to make the studies. The appointees are announced as Herbert S. Karch, of Pittsburgh, who was graduated from Carnegie Institute of Technology in June, 1924, with a B.S. degree in metallurgical engineering; Ernest L. Bauer, of Butler, Pa., and Joseph M. Campbell, of Duquesne, Pa., who were graduated in June, of 1924, from Pennsylvania State College, with B. S. degrees in metallurgical engineering; and Wayne L. Cockrell, of Dayton, Ohio, a graduate of 1924 from the University of Cincinnati with the degree of chemical engineer.

Entire Country Competed

The appointments to the fellowships, according to the announcement, were made from applications received from all parts of the country.

Karch will be assigned to a senior investigator representing the Pittsburgh Station of the U. S. Bureau of Mines and will study "Corrosion of metals due to high pressure steam"; Bauer and Campbell will collaborate with a Bureau of Mines investigator in "A study of the atmosphere in open-hearth steel making furnaces as affecting refractories." Cockrell has been assigned to work under the direct supervision of Professor Fred Crabtree, head, and Associate Professor F. F. McIntosh, of the Department of Metallurgy in the study of "The effect of various percentages of phosporus on the physical properties of low carbon steel."

Washington News

Navy Department Inspects Its Oil-Shale Reserves

Rear Admiral Harry H. Rousseau of the civil engineering department of the United States Navy, accompanied by representatives of the Bureau of Mines and the Geological Survey, has just completed a four-day inspection of the deposits of oil-shale in the district known as Naval Oil-Shale Reserve No. 1 in Colorado. Included in this reserve are 45,444 acres of oil-shale land comprising some of the richest deposits in the Grand Valley vicinity. Rear Admiral Rousseau's inspection party included E. R. Campbell and A. B. Bauer of the Bureau of Mines, James Duce, Colorado State Oil Inspector, and W. H. Bradley of the United States Geological Survey.

Although Admiral Rousseau refused to comment on the purpose and results of his investigation, it is generally regarded by oil-shale men in Denver as an outgrowth of the recent visit to this district by representatives of the Presidential Oil Commission. It is known that the Navy has recently revised its interest in oi!shale development and it is confidently expected that arrangements will be made whereby the Bureau of Mines will be authorized to establish a large-scale retort plant on the Naval Reserve in order to test out and develop practical means for producing oil from shale.

American Institute of Chemists Forms Washington Chapter

A Washington chapter of the American Institute of Chemists will be formed soon. This was made known following a meeting of local members of the institute at the Raleigh Hotel during the past week.

Those attending the meeting discussed particularly the re-classification act in reference to government chemists. Although no detailed information was made public, it was made plain that there is wide dissatisfaction among government chemists over the act, and that plans have been discussed as to the most feasible method of bringing about changes in the act. Dr. James McGuire read a paper before the meeting. This was followed by a round table discussion. James F. Couch presided.

Industrial Alcohol Committee To Meet August 14

The Commissioner of Internal Revenue has requested his advisory committee on industrial alcohol to meet in Washington Aug. 14. While no announcement has been made as to the purpose of the meeting, it is expected that there will be discussion of the whole matter of the proposed separate Bureau of Prohibition, as well as consideration of the prohobition unit's attempt to require permittees to stamp stipulations on invoices, making it a condition of the sale that purchasers will allow prohibition agents to inspect stocks and will furnish them with lists of their customers. In this latter connection, the point has been raised that this stipulation runs counter to the rulings of the Supreme Court under which manufacturers may not control in any manner whatsoever the wholesaling or retailing of his product.

New Soap Company in Italy

According to a report from James B. Young, consul at Venice a new corporation has been formed in Mira, Italy, for the production of soap and candle products. The initial capital is 1,000,000 lire, which will be increased shortly to 40,000,000 lire. This new corporation was founded by absorbing two of the largest concerns in this industry. Although there are several smaller stearic and glycerine industrials, and many soap and candle manufacturers in Italy, there is no concern engaged in the production of these products which is nearly as large as this new corporation which may dominate the Italian market in stearin, candles, soap, and affiliated chemical products.

A. C. S. Sponsors New Book

A book dealing with chemistry in the industries, which has been prepared under the auspices of the Committee on Prize Essays of the American Chemical Society, will be ready for distribution next month. Each of the book's 22 chapters has been written by men actually engaged in the industry with which it deals.

German Fertilizer Industry in Unfavorable Position

Conditions in the German fertilizer industry continue unfavorable, according to a report to the Department of Commerce from Consul General F. T. F. Dumont at Frankfort-on-Main. Even nitrogen producers, who until about April could report fair business, have been affected by the general scarcity of money, the report states.

The May report of the Nitrogen Syndicate shows an increase in business following the settlement of the lockout at the Oppau plants. Business in sulphate of ammonia was particularly quiet. There is little or no chance of price reduction, according to the report, because of the upward trend of raw materials and wages. The actual consumption of nitrogen fertilizer in the agricultural year ended May 31 may prove to be not less than in the previous year, and it is probable that considerable stocks which farmers had on hand were used also. Agreements have been renewed for syndicalized sales of nitrogen. As it is impossible to manage business in the occupied territory from Berlin, the Nitrogen Syndicate on June 1 opened a sales office in Bochum for the sale of sulphate of ammonia manufactured in the Ruhr district and another office at Ludwigshaften-on-Rhine for the southern part of the occupied territory.

Conditions in the domestic potash industry are reported more unsatisfactory than for many months, even the strongest companies being able to keep going on only a small scale. Sales of potash in the first quarter of 1924 were 110,845 metric tons K_2O as compared with 230,722 in the same period of 1923.

Increased Call for Fertilizers

Heavy increases are reported in the demand for fertilizers. The improved demand does not come entirely from the wheat and corn-growing sections. Much heavier orders are being placed by the South. Southern business has been fairly satisfactory, due to the prices which have prevailed for cotton for the past two years. The indications that the South will increase its use of fertilizer are explained by the fact that the South raises many agricultural products besides cotton and to that extent is sharing in the advances which have so altered the outlook for farmers of the North and West. All of the fertilizer buying is showing a marked increase in the tendency to use the higher analysis fertilizers.

Seventh Supplemental List of Dye Standards Issued

The Treasury Department has issued its seventh supplemental list of standards of strengths of coal-tar dyes for purposes of appraisal. The seventh list adds 12 dyes to the standards, and mentions by name 10 other dyes for similitude. Other supplemental lists will be issued in the near future, each to contain from 10 to 15 additional dyes which may be used in comparing importations with the strength of commercial imports of similar dyes prior to July 1, 1914, the specific duty of 7 cents per pound being assessed in the proportion that the strength of the importation bears to the strength of its pre-war comparative.

Third Power Show Promises To Be Largest Yet Held

Over 260 exhibitors have been assigned space at the Third National Exposition of Power & Mechanical Engineering which will be held in the Grand Central Palace, New York City, from Dec. 1 to Dec. 6. As this number is more than two times greater than those who had engaged space on August first a year ago, the indications are that the coming event will be of considerable size.

The Exposition will, as usual, parallel the meetings of the American Society of Mechanical Engineers and the American Society of Refrigerating Engineers. The A.S.M.E. meeting will be held in the Engineering Societies Building, 29 West 39th St., New York City, and the A.S.R.E. meeting will be held at the Hotel Astor, New York City. Plans are under way for the American Society of Heating and Ventilating Engineers to have a gathering of local sections during the time of the exposition.

Briefs Called for in Sodium Nitrate Tariff Case

Refiners Contend Present Tariff Does Not Provide Free Entry For Refined Nitrate

All parties at interest have been given until the close of business August 11, to file briefs with the Customs Division of the Treasury Department on the question of whether only crude sodium nitrate is entitled to free entry through the ports under Paragraph 1667 of the Tariff Act of 1922. Briefs are expected in opposition to an affirmative ruling by the Manufacturing Chemists' Association and various importing interests and in support of a ruling of this character by domestic refiners of imported crude nitrate.

While no decision has been reached by the classification experts of the Customs Division, the indications have been that they would hold because of the phraseology and punctuation of Paragraph 1667 that only crude sodium nitrate is entitled to entry on the free list. The effect would be to make refined nitrate dutiable at 25 per cent ad valorem under Paragraph 5 of the dutiable list as a chemical salt not specially provided for.

Sodium nitrate imported for fertilizer purposes is said to be generally about 95 per cent pure nitrate. There are importations for chemical purposes and for explosives which enter at 96 or 97 per cent strength, however. The question of classification was raised by a domestic refiner who produces 100 per cent pure sodium nitrate from the imported crude material for use in preserving meats. Little or no importations of refined nitrate have been coming in, but it is understood that interests in Chili are preparing to refine the product and export it; hence the question of duty was raised.

Whether a decision merely reciting that only crude sodium nitrate is entitled to free entry under Paragraph 1667 would make dutiable the higher concentrates now being imported free for chemical and explosive use, and make dutiable only the absolutely refined, or 100 per cent pure sodium nitrate, remains to be seen. It is understood that the Customs Division will not attempt to define crude sodium nitrate until there is a specific sodium for such definition. The appraising officers would use their judgment, if a ruling such as is said to be contemplated were to be issued, until and unless a direct demand for a specific definition were raised.

No form of sodium nitrate ever has been dutiable in the history of United States tariffs. The contention of those opposing a duty on the refined product is that it was the intent of Congress to continue this policy.

However, Paragraph 1667 reads: "Sodium: Nitrate, sulphate, crude, or salt cake, and niter cake," these to be free. The classification experts are inclined to believe that the word "crude" qualifies both "nitrate" and "sulphate," and that nitrate which is not crude must therefore be dutiable.

A more liberal construction might be placed on the paragraph were it not for the fact that there is evidence that the phraseology was called directly to the attention of Congress before the Tariff Act was passed. In a memorandum regarding Paragraph 1667 as drafted, the Tariff Commission suggested that sodium cyanide, which originally was in this paragraph, be transferred to Paragraph 1565, with other cyanides, and that the application of the word "crude" be made clear. Congress transferred sodium cyanide, as suggested by the Commission, but left the phraseology of the remainder of Paragraph 1667 unchanged.

Bay Sulphite Co. Change Hands

It has been officially announced that the Bay Sulphite Co., Limited, at Port Alfred, on the Saguenay River, has been taken over by the Port Arthur Pulp and Paper Corp.

The Bay Sulphite Co., Ltd., was organized at the suggestion of the British government and through the co-operation of leading British and French newspapers and paper manufacturers, including companies owned by or supplying the London *Times*, *Dail Mail*, *Daily Telegraph*, *Daily Mirror* and *Evening News*. The company commenced operations in 1918. The capacity has been increased to 40,000 long tons per annum. The company, in its own right or through its subsidiary, controls approximately four and a quarter million cords of pulp-wood.

Trade Notes

R. H. Luthin, Inc., 191 Bowery, New York, has been petitioned into bankruptcy. Liabilities are placed at about $15,000.

Frank B. Foster, president of the Congoleum Co. has gone to England and, it is reported, will complete a merger between his company and a prominent English concern.

The Lafayette Fluorspar Co., subsidiary of the United States Steel Co., has purchased the Big Four mine, near Sheridan, Ky. This property has been a large producer of fluorspar for some time.

Exports of manganese ore from Brazil to the United States in May, totaled 10,800 metric tons, valued at $112,510, compared with 22,500 tons, worth $236,052, in May, 1923, the decrease being attributed to the continued lack of transportation facilities. The price in May, 1923, remained stationary at $10.50 per ton.

The American Silver Isle Products Co. is building a soap plant at Portland, Ore.

E. M. Herr, president of the Westinghouse Electric & Manufacturing Co., has accepted the chairmanship of the committee which is organizing the American Industrial Mission to Mexico.

C. P. Schlicke, formerly with the Hoffman-La Roche Chemical Works, Inc., has become affiliated with the Dissosway Chemical Co. as vice-president and director of sales.

Silica Producers Seek New Uses for their Products

Undertake Research Program to Broaden Consuming Markets —Plants Increase Products

While the tendency in many industries has been to curtail research work when business slows down, just the opposite policy has been followed by the producers of silica. With the decline in building and in steel making, the absorbing power of two of the best customers of the silica producers was reduced greatly. Many of those engaged in the industry have recognized that one of the best ways to improve the situation is to undertake a program of research looking to new uses for their product and a broadening of their market so that their industry will be less dependent upon the two industries mentioned. This is the testimony of W. M. Weigel, mineral technologist on the staff of S. C. Lind, the chief chemist of the Bureau of Mines, who just has returned to his office in Washington after a visit to the silica-producing districts of Pennsylvania, Ohio, Illinois, Missouri and Minnesota. Research work already done has pointed the way to increased use of silica in cleaning compounds. A tendency was noted at most plants to increase the number of products so as not to be dependent upon a single industry. For example, a plant which formerly produced only glass sand, now has an output of roofing sand, filter sand and sand blast sand.

The prospects are good for a very large increase in the demand for sand blast sand. This method of cleaning the exterior surfaces of stone buildings has been perfected to the point where the cost is only a fraction of that which would be required to apply paint to an equal area of wood surface. The work proceeds more rapidly than does painting and requires relatively few workmen. The improvement in the appearance of a stone building after the application of the process is entirely comparable, Mr. Weigel points out, to the improvement following the painting of a frame structure. A repetition of the cleaning is not required as frequently as is repainting. For these reasons it is believed that there will be a very material expansion in the use of sand blast sand.

Mr. Weigel found the Jasper mine in Minnesota continuing to displace, to the limit of its capacity, the Belgian flint largely used in the lining of tube mills. The quartzite produced at the Jasper mine is said to be just as satisfactory for silex linings as are the linings made of the imported flint. This mine is the only producer in the United States of material suitable for use as tube mill linings.

The Ohio quarries continue to meet the demand of the United States for pulp stones. Despite the expansion in the country's output of mechanical pulp for paper making, the demand for stones has remained practically constant. This is explained from the fact that methods have been developed whereby the stones can be used more economically and their life extended.

Exports of Chemicals and Allied Products Decline

Values 10 Per cent Lower in First Half Half of Year as Compared with Those for 1923

According to the preliminary figures, the exports of chemicals and allied products during the first 6 months of 1924, dropped 10 per cent from the first six months of last year, $67,328,598 worth having been shipped abroad this year as compared with $74,836,422 last year. During the second quarter of the current year, the exports recorded a 7 per cent advance over the first quarter of this year, but a 15 per cent decline from the high figure of $40,751,587 for the second quarter of last year.

The influence of the $11,693,764 worth of chemicals and allied products exported during the month of June, 1924—$3,000,000 less than the previous June—undoubtedly caused the adverse balance of the trade during the second quarter as well as during the first half year when compared with the corresponding periods of 1923. Whereas last year, during the month of June, exports were the highest of the year with the exception of July, the current June figure failed to attain the May figure although it surpassed those of the other months of the year.

Practically the same classes as have been showing losses month by month throughout the year, namely, naval stores, gums and resins, sulphur, industrial chemicals, coal-tar chemicals, pigments, paints and varnishes, fertilizers, and explosives, consequently recorded decreases for the 6 month period, while the closely related products of the fine chemical section—crude drugs, medicinal and pharmaceutical preparations, essential oils, and perfumery and cosmetics, total values of which, however, form but a relatively small percentage of the total, gained steadily, showing a favorable balance for the 6 months' period.

Fertilizers Decline 23 Per Cent

Of the major groups included under the subject of chemicals and allied products, the 23 per cent drop in the value of the exports of fertilizers and fertilizer materials from $11,372.639 in January-June, 1923 to $8,731,063 in January-June 1924, was responsible to a large extent for the decline in the total group. Foreign sales throughout each month of the second quarter of the present year have been considerably below those of the preceding year. The loss in value showed that fertilizers and fertilizer materials were purchased cheaper during this period than last as the tonnage shipped in January-June, 1924, was less than one per cent under the tonnage of last year. Sulphate of ammonia shipments fell 39 per cent from $6,147,746 (86,665 tons) in January-June, 1923, to $3,743,767 (60,570 tons) in 1924. Foreign demand for phosphate rock likewise dropped in value from $2,872,460 to $2,453,852 while the quantity advanced from 396,607 tons to 400,541 tons.

Exports of naval stores, gums and resins and explosives tied for second place as to rate of decrease with 15 per cent. After the high figure of $12,429,412 for exports of naval stores, gums and resins, during the first half of last year, it was not remarkable that this year's figure should have shown a loss although at that it reached $10,433,790, a gain of over $2,400,000 for the first half of 1922. June was the peak month of this year for values.

Shipments of rosin, one of the leading commodities of this group, rose in quantity from 629,955 tons in January-June, 1923, to 632,694 tons in January-June, 1924, but dropped in value from $5,971,538 to $5,573,237.

Less spirits of turpentine, 4,228,815 gal. valued at $3,900,476, were dispatched to foreign countries in the first half of the current year than last year. On the other hand, larger amounts of wood turpentine and turpentine substitutes were sold to foreign purchasers during the periods under discussion, 268,731 gal. valued at $215,561 of the former, and 565,948 gal. valued at $212,214 of the latter having left this country for foreign countries.

Depression in Coal-Tars

Coal-tar chemicals followed the general depression with a 12 per cent loss, the aggregate value having reached $5,531,678 in 1924; this figure, however, exceeded the figure for the first half of 1922. The small shipments made in April and June were largely accountable for this loss as during the first quarter exports were 14 per cent above the exports for the first quarter of 1923. Coal-tar crudes declined 20 per cent to $2,449,061 for the first 6 months of 1924, intermediates, 3 per cent, to $214,672, and finished products, 6 per cent, to $2,867,940. Nearly double the amounts of coal-tar medicinals were shipped abroad during the current year as last year. A reduction of 6 per cent in the value of the exports of coal-tar colors, dyes, and stains characterized the trade for goods of this type, figures for which were 7,470,977 lb., valued at $2,553,217 in January-June, 1924. In line with this general decline foreign sales of vegetable dye extracts fell 4 per cent to $206,284 (1,617,243 lb.).

The total exports of industrial chemicals were 10 per cent under those for the first 6 months of 1923, the aggregate value having equalled $12,728,349. As will be observed from the following table, the more important heavy chemicals such as sodas and sodium compounds, acetate of lime, aluminum sulphate, bleaching powder, recorded losses, others such as sulphuric acid, calcium carbide, dextrine, formaldehyde, and glycerine, gains, while still others, the total class of acids and anhydrides, copper sulphate, advanced in quantities, and declined in values.

Exports of Leading Chemicals

	Jan.-June, 1923 Lb.	Jan.-June, 1924 Lb.
Acids and anhydrides	10,847,002	11,769,356
Acetic acids	540,193	263,017
Sulphuric acid	3,568,630	5,887,873
Alcohols,		
Aluminum sulphate	17,308,240	15,564,783
Calcium compounds		
Acetate of lime	15,049,047	10,921,320
Calcium carbide	3,292,775	6,175,839
Bleaching powder	16,785,683	11,533,276
Copper sulphate	1,417,374	1,634,296
Dextrine	8,803,293	12,729,908
Formaldehyde	694,070	1,550,142
Glycerin	692,111	876,047
Potash		
Chlorate of	131,585	424,824
Bichromate of	2,231,428	544,242
All other	2,817,434	1,546,537
Sodas and compounds	206,941,400	157,442,295
Borax	21,770,090	17,694,517
Soda ash	14,351,970	11,732,694
Silicate	15,266,533	14,388,750
Caustic soda	58,703,050	44,262,355
Sodium bicarbonate	8,803,387	7,789,756

Financial

Arrangements have been made to retire on Oct. 1, the outstanding issue of General Asphalt Co.'s 6 per cent debentures due April 1, 1925. Net profit of the company for the first 6 months of this year, was $534,000.

The Columbian Carbon Co. for quarter ended June 30, reports net income of $531,930 after charges, taxes, depreciation and depletion, equivalent to $1.32 a share earned on the 402,131 outstanding shares of no par stock. This compares with $696,061, or $1.73 a share, in preceding quarter.

For six months ended June 30, the Diamond Match Co. reports net income of $898,525 after interest, depreciation, federal taxes, etc., equal to $5.29 a share earned on the $16,965,100 outstanding capital stock. This compares with net income of $903,732 or $5.32 a share in corresponding period of 1923.

The Vacuum Oil Co. has declared an extra dividend of 25c. in addition to the regular quarterly dividend of 50c. per share.

The Mathieson Alkali Works, Inc., for quarter ended June 30, reports net income of $266,071 after depreciation, but before federal taxes, equivalent after allowing for regular preferred dividends to $1.83 a share earned on $5,885,700 outstanding common stock. This compares with $93,258, or 37c. a share, on the common in preceding quarter, and $395,238, or $2.93 a share, on common in second quarter of 1923.

The American Window Glass Co. has declared a regular semi-annual dividend of 3½ per cent on the preferred, payable Sept. 2 to stock of record Aug. 20.

The Libbey-Owens Sheet Glass Co. has declared quarterly dividends of 50c. on common and $1.75 on preferred.

For 6 months ended June 30, the Ajax Rubber Co., Inc., reports net profits of $143,517 after taxes, depreciation, interest and reserve for price rebates. This is equivalent to 33c. a share earned on 425,000 shares of no par capital stock, and compares with $414,720, or 97c. a share, in first half of 1923.

Deficit of $744,767 reported by Central Leather Co. for the second quarter of this year was the result of a reduced volume of business throughout the period, high overhead due to operations between 40 and 45 per cent capacity, and decline in hide market which forced a lower inventory.

Men You Should Know About

JOHN H. AMES recently left the Wm. S. Merrell Co. of Cincinnati to become production manager of the Reed-Prentice Co. at Worcester, Mass.

C. F. BANKS is now chief engineer of the Empire State Ice Co., located near Albany, N. Y.

G. A. BOLE, superintendent of the Bureau of Mines Ceramic Station at Columbus, Ohio, is in Seattle conferring with the staff at the experiment station there on certain phases of ceramic problems. En route to Seattle he stopped at Rolla, Mo., to confer with the staff there in regard to the effort being made to secure better refractories for the zinc industry.

Prof. B. B. BOLTWOOD of the chemical staff at Yale University, prior to sailing for Europe, visited the Government laboratories in Washington with the idea of acquainting himself with the latest progress which has been made in research work.

W. PAUL EDDY, formerly chemist with the Crucible Steel Co. of America, is now chief chemist and assistant metallurgist with the Geometric Tool Co., at New Haven, Conn.

HUNTER GRUBB, general manager of the Paints and Varnish Division, E. I. duPont deNemours and Co., Wilmington, Del., was one of the principal speakers at a convention of the eastern division of this branch of the company's business, held at Philadelphia, Pa., July 31 and August 1.

Dr. F. M. HILDEBRANDT, formerly with the Ward Baking Co., has accepted a position in the research department of the U. S. Industrial Alcohol Co.

JOSEPH F. HOLLYWOOD, formerly connected with the Marietta Refining Co., has been elected treasurer of Coal-Tar Dyes, Inc., 132 Front St., New York, a recently organized company.

CLARENCE H. LORIG, a graduate of the course in mining engineering of the University of Wisconsin College of Engineering, has been awarded the fellowship given by the Stowell Co. of Milwaukee for research to be carried on at the university. The Stowell Company has two malleable plants and is seeking facts on the transformations and structure of malleable iron during the annealing process.

ENOCH PERKINS, heretofore connected with the Replogle Steel Co., New York, has sailed for Noumea, New Caledonia, where he will engage in chrome mining operations as manager for French interests. Mr. Perkins is a graduate in mining engineering of the University of Idaho.

L. C. PRATT has become manager for the Empire Refineries, Inc., refined petroleum products, at Chicago, Ill.

NUGENT A. RAGLAND, ceramic engineer for the Perth Amboy Tile Works, Perth Amboy, N. J., gave an interesting address before the members of the local Kiwanis Club, July 29, on the subject of "Developments in the Ceramic Industry."

GEORGE M. ROLPH, general manager for the California & Hawaiian Sugar Refining Corp., San Francisco, Cal., has returned to that city from a business trip in the East.

WILLIAM FURBER SMITH, formerly assistant engineer of tests at the Kansas State Highway Laboratory, Manhattan, Kansas, is now assisting in the installation of road materials laboratory for the Oklahoma State Highway Dept., Oklahoma City, Okla., where, as assistant testing engineer. he will have charge of inspection of asphalt paving and all bituminous and chemical testing.

ROBERT STEINEMANN, heretofore vice-president of the Iron Builders Corp., has become connected with the Monsanto Chemical Works, Inc., at New York.

JOHN R. SUYDAM, JR., has become associated with Banks and Craig, engineers and chemists, of 51 East 42nd Street, New York, and Telegraph Building, Harrisburg, Pa.

Prof. HUGH S. TAYLOR of Princeton University has departed on a six months leave of absence in Europe, during which time he will visit laboratories and industries in England, France, Germany and Scandinavia.

W. A. TAYLOR, heretofore head of the organic chemical division at Edgewood Arsenal, Edgewood, Md., has become connected with the LaMotte Chemical Products Co., Baltimore, Md.

WALTER C. TEAGLE, president of the Standard Oil Co. of New Jersey, is now abroad in connection with European business of the company.

Prof. J. S. THORPE, of the Imperial College at Kensington, London, in connection with his attendance on the sessions of the British Association for the Advancement of Science, will accept an invitation from Gen. Fries, to visit Edgewood Arsenal; from Director Bain to visit the Bureau of Mines laboratories in Washington and Pittsburgh, and from Dr. F. G. Cottrell, to visit the Fixed Nitrogen Research Laboratory.

Calendar

AMERICAN CERAMIC SOCIETY, Los Angeles, Cal., Oct. 6 to 7.

AMERICAN CHEMICAL SOCIETY, sixty-eighth meeting, Cornell University, Ithaca, N. Y., Sept. 8 to 13.

AMERICAN ELECTROCHEMICAL SOCIETY. Detroit. Oct. 2 to 4.

AMERICAN FOUNDRYMEN'S ASSOCIATION, Milwaukee, Wis., Oct. 11 to 16. 1924.

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS, Birmingham, Ala., Oct. 13 to 15.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS, New York, Dec. 1 to 4.

AMERICAN SOCIETY FOR STEEL TREATING, Boston, Sept. 22 to 26.

FRANKLIN INSTITUTE CENTENNIAL. Philadelphia, Sept. 17 to 19.

INTERNATIONAL MATHEMATICAL CONGRESS, Toronto, Aug. 11 to 16.

MANAGEMENT WEEK. Auspices of American Society of Mechanical Engineers, New York City, Oct. 20 to 25.

PACIFIC COAST GAS ASSOCIATION. Santa Barbara, Calif., Sept. 15 to 19.

Millikan Honored by Trinity

Dr. Robert A. Millikan, recent recipient of the Nobel award in physics, was granted the honorary degree of Doctor of Science, Trinity College, Dublin, on June 27. The Latin oration introducing the American secientist was delivered by Sir Robert Tate, a translation of which, according to the *Irish Times*, is as follows:

"Right gladly do I now bring before you a man who, in physical research, has won the highest fame; a son of whom his native land, America, is rightly proud—Robert Andrews Millikan. Students of physical science are well acquainted with his numerous works, both those that accurately explain the theory of light, optics and sound, and those that have in the most lucid manner solved the problems of heat, electricity and the motions of molecules.

No less worthy of renown is the investigation by which he demonstrated the nature of the electron, a word first used, I believe, more than forty years ago by an eminent graduate of this university, Johnstone Stoney. Democritus, who affirmed that the divisibility of bodies was finite, would certainly have laughed at the idea. Modern physicists, however, believe that the chemical atom, as they call it, is composed of the most minute particles revolving at the greatest speed, the size of which, compared with that of the atom, is much in the same ratio of a pin's point to the dome of St. Paul's. To these elements, or point charges of electricity, if we so prefer to call them, the name electron, derived from their nature, has been given.

"Now, the chief merit of our guest is that he was the first to investigate thoroughly the properties of these elements, that he accurately estimated their charge, and proved the correctness of his estimate by exceedingly subtle experiments. Will anyone deny that so celebrated a man is worthy to have his name added to our roll? No one, assuredly. Give him, then, while he there inscribes it, your loud applause."

Manufacturing Chemists To Discuss Transportation Problems

The traffic committee of the Manufacturing Chemists' Association will meet at India House, New York, August 11. The traffic committee recently was enlarged. It now is comprised of twelve members carefully chosen so as to be representative of branches of the industry having different transportation problems. This meeting is for the purpose of mapping out the year's work and to discuss the general problems facing manufacturers of chemicals.

The report of the sub-committee of the Committee on the Transportation of Poisonous Articles, which deals with powdered insecticides, has been approved by the full committee and by the executive committee. It is said that the report will be submitted in the near future to the Bureau of Explosives of the Interstate Commerce Commission.

Market Conditions

Wood Distillation Products Work Into Firmer Position

Improved Demand Reported to Have Reduced Surplus Stocks—Selling Competition Also Lessened

AMONG the developments of the past week was a better feeling in the market for wood distillation products. Generally speaking, prices for the latter have been depressed because of large accumulations at producing points aided by keen competition from other products. Some of this competition has disappeared and as buying interest has been more prominent, values have been steadier and in certain instances have moved upward. Acetate of lime remains at unchanged levels but acetone is firmer and wood alcohol was advanced 2c. per gal. Formaldehyde, likewise, is more firmly held with higher selling prices regarded as probable.

Reports from consuming industries continue favorable and operations are being extended in many lines. A prominent manufacturer states that business in the cotton textile industry for the first 6 months of this year was less favorable than for any of the past 5 years. He added that such periods of depression usually are of short duration and are succeeded by an active period. Reports from glass producing centers say there has been no sensational advance in business but rather a steady flow of new orders. Orders for rubber goods have brought about the reopening of plants which had been closed for 5 weeks. Stocks of leather are being gradually reduced. In short, the tenor of reports is favorable for a freer distribution of raw materials with some reflection of this condition already apparent in the markets.

In connection with the application for a ruling on the import duty on refined nitrate of soda, Washington advices state that interested parties have been asked to submit briefs to support their contentions. It is stated that indications are regarded as favoring an interpretation of the Tariff act which will make importations dutiable to the extent of 25 per cent ad valorem, but the question will remain in doubt until official action has been taken. It was also stated that work had been started on the investigation into production costs of cottonseed and other vegetable oils, with investigators already active in primary centers.

The weighted index number for the week moved upward slightly. Price fluctuations, however, were not numerous. The tendency toward higher levels is regarded as significant as revealing a more confident feeling on the part of manufacturers. It also bears out reports of improved buying interest and adds to the belief that the latter half of the year will find better business in general than was experienced in the first half.

Acids

Domestic producers of tartaric acid became more prominent during the week because of lower priced offerings on their part. They put out a new schedule with quotations for crystals and powdered at 29c. per lb. which is a reduction of 1c. per lb. from the previous price level. Imported grades of tartaric still undersell the domestic as spot offerings of the former were available at 27c. per lb. Call for citric acid has been consistent and recent declines in the selling prices of domestic grades have placed them in a position to compete favorably for business. Moderate buying of formic acid was reported with imported grades selling at 12½c. per lb. Oxalic acid still holds an irregular course with sales of imported on spot at 9½c. per lb. Imported oxalic is finding keen competition from domestic but arrivals from abroad for several months have been large and it is stated that the imported material is filling a large part of consuming requirements. Lactic acid is moving moderately with a fairly steady tone to values. Mineral acids are quiet with supplies liberal.

Acetone Firmer — Alcohol Marked Up in Price—Carbon Tetrachloride Easy—Formaldehyde Steady—Tartaric Acid Lower—Competition Weakens Oxalic Acid — Barium Salts More Free—Copper Sulphate Steadier—Tin Salts in Firm Position—Alkalis Quiet—Arsenic Sells for Forward Deliveries—Orders Placed for Nitrate of Soda

In most cases holders are not forcing matters and look for an increase in demand in the near future which will tend to reduce accumulations. In the meantime buyers can arrange purchases on private terms with prices depending on quantities and sellers.

Potashes

Bichromate of Potash — Very little change was noted in this material last week. Buyers are holding down demands and small lots make up the greater part of the present movement. Export buying is quiet and without new feature. Open market quotations for bichromate are irregular because of the difference among sellers but 9c. to 9½c. per lb. cover the ranges according to seller and quantity.

Caustic Potash — While buyers are taking in stocks spasmodically, there is a fair movement to consuming points and certain sellers still refuse to meet the lowest prices quoted. Imported material on spot sold at 6½c. per lb. and offerings are large enough to warrant a continuance of that price. Shipments also are held at 6½c. per lb.

Chlorate of Potash—Offerings of imported chlorate have been prominent and the outlet has been limited. Large consumers are covered ahead and call for fresh supplies is slow. Prices have been easy with quotations at 6¾@7c. per lb.

Permanganate of Potash — Arrivals of imported permanganate have not been large. This has tended to prevent accumulations and buyers find a steady market whenever they put out inquiries. Spot goods are quoted at 13¾@14c. per lb. and attempts to shade the inside figure have not been successful.

Prussiate of Potash — Consuming trades have shown very little interest in spot prussiate. Asking prices are being maintained at 18c. per lb. for yellow prussiate but shipments are available at 17½c. per lb.

Sodas

Acetate of Soda—Surplus offerings have been taken up and some sellers are reported to be sold ahead. There has been an effort to establish 5c. per lb. as an inside price for carlots at works but 4¾c. per lb. can be done in certain quarters.

Bichromate of Soda—Some inquiries for fair sized lots have been in the market and buyers find it impossible to do business at private terms. Jobbing trade is more regular but the gain in orders is gradual. Asking prices are given at 7@7½c. per lb.

Caustic Soda—Export inquiry was more quiet or at least inquiries were less widely distributed. Quotations for export still vary according to seller and to point of destination with 2.85c. to 3c. per lb., representing sellers views. Some improvement is reported in domestic business. There are rumors to the effect that long term contracts have been closed with domestic buyers on a basis of 2.85c. per lb., in carlots, at works, but producers report no change in their prices and quote at 3.10c. per lb., at works.

Nitrate of Soda—Reports were current that a group of fertilizer manufacturers had placed a contract covering part of next seasons requirements.

Details were not made public regarding the quantity and price but the latter is said to depend on fluctuations in transportation rates and exchange. The spot market has been quiet but limited offerings hold values on a firm basis for immediate deliveries and $2.48@$2.50 per 100 lb. is given as the market quotation. Refined nitrate has attracted more attention because of reports that competition would increase and interest was heightened because of ambiguity in the tariff law which makes it uncertain, whether or not, such importations are entitled to free entry. Domestic refiners have asked that imports be dutiable at 25 per cent ad valorem and this has been opposed by importers and consumers. The Customs Division given interested parties until the close of business today, to file briefs in support of their views.

Nitrite of Soda—Offerings of domestic nitrite are not heavy enough to cause any selling competition and importers are not using pressure. The result is, the market maintains a steady tone. Large consumers are receiving supplies against contracts. New business is taken on a basis of 9c. per lb. for domestic grades, 8¾c. per lb. for German, and 9c. per lb. for Norwegian.

Miscellaneous Chemicals

Acetone—For some time this material was under pressure due to the fact that different methods of manufacture made a difference in producing costs. This competition has lessened as makers who use the fermentation method have advanced their prices and other producers have followed suit. Current quotations are on a basis of 16c. to 17c. per lb., according to maker.

Arsenic—Reports are heard of further sales over the balance of the year and some domestic producers are said to be sold ahead for the present. The spot market is not active and holders of imported grades are not pressing matters. Spot quotations are 7¾@8c. per lb. Shipments from abroad are quoted at 7⅝c. per lb., for Japanese, and 7½c. per lb. for European.

Barium Salts—Domestic makers are using their output to take care of existing orders but stocks of imported have gained in volume. Prices are easier as buyers are inactive and carbonate has been offered at $59 per ton on spot and $57 per ton for shipment. Chloride also is lower with spot goods at $77 per ton and shipments at $75 per ton.

Copper Sulphate—Competition from foreign markets has been less keen and cables have indicated higher prices abroad. The metal market also has shown a rising tendency and domestic sulphate is quoted at 4.50@4.60c. per lb.

Formaldehyde—Strength in some of the raw materials combined with the fact that production has been along reduced lines, has steadied prices for formaldehyde and given a firmer tone to the market. No actual change in price has been made and carlots are still to be had at 9c. per lb., at works.

Phosphorus—While small lot offerings of yellow phosphorus were on the market a short time ago at price concessions, buyers state that the supply generally has been small. Domestic producers are sold ahead and imported is firmly held and prices are largely nominal.

"Chem. & Met." Weighted Index of Chemical Prices

Base = 100 for 1913-14

This week	**164.12**
Last week	163.95
Aug., 1923	168.00
Aug., 1922	152.00
Aug., 1921	158.00
Aug., 1920	264.00
Aug., 1919	251.00
Aug., 1918	278.00

The advance in denatured alcohol, refined glycerine and acetone caused the weighted index number to gain 17 points for the week.

Sal Ammoniac—Holders of white imported have been offering freely and the market was in an easy position with carlots available at 6¼c. per lb. in the spot market. Sales of less than carlots were made at 6⅜c. per lb.

Tin Salts—The stronger position of the metal has influenced the market for the salts and prices are quoted as firm. Tin oxide is generally held at an inside figure of 52c. per lb. but there has been, and still is, some difference in price according to seller. A higher price schedule for August deliveries went into effect on the first of the month, for tin crystals and bichloride of tin. The former is offered at 35½c. per lb. and the latter at 14c. per lb.

Alcohol

Producers announced a general advance of 2c. per gal. for denatured alcohol. In view of the recent uplift in basic materials the advance did not come unexpectedly. Demand has been good. No. 1 special is now held at 46c. per gal., in drums, and 52c. per gal., in bbl., carload lots. Formula No. 5, 188 proof, closed the week at 45c. per gal., in drums, and 51c. per gal., in bbl., carload lots.

Methanol was firmer, but unchanged in price. Pure in tank cars, was offered at 75c. per gal., prompt shipment from works. On the 95 per cent grade, in bbl., 74c. per gal was asked. Production has been curtailed. Butyl alcohol was in steady demand, contract shipments absorbing the bulk of the output. Producers quote 30c. per lb.

Coal-Tar Products

Stocks of Benzene Small and Market Gains in Strength—U.S.P. Phenol Unchanged—Slow Trade in Intermediates

INTEREST centered in the action of the market for benzene. While no price changes took place, it was reported that few sellers could take on prompt or nearby business and some of the smaller operators were about to advance their selling ideas. Crude petroleum registered another decline, but this was offset by the more favorable outlook for gasoline, the demand for the latter improving in nearly all directions. Demand for motor benzene was good. Production of the coal-tar product remains light and it now appears quite certain that supplies available for August delivery may be no larger than in July. Offerings of U.S.P. phenol for prompt shipment were fairly liberal, but leading producers announced no further changes in prices. Naphthalene flake was easy on selling pressure. Aniline oil was regarded as steady. The call for intermediates showed little if any improvement and prices named were more or less nominal.

Aniline Oil and Salt—Scattered business in aniline oil went through on the old basis of 16c. per lb., drums extra, shipment from works. Inquiry was slow all week. Aniline oil for red was nominal at 40c. per lb. On the salt first hands held out for 22@23c. per lb., depending upon the quantity.

Beta-naphthol — Producers offered supplies at 24c. per lb., carload lots, f.o.b. works. For smaller parcels quotations ranged from 25@26c. per lb. immediate delivery. Demand was quiet and the market barely steady.

Benzene—There was a steady inquiry for benzene, principally the motor grade, and with production well under what it was a year ago, sellers have experienced difficulty to supply ordinary wants. The undertone of the market was quite firm, smaller operators being inclined to raise prices. Leading interests again quote the market at 23c. per gal. on the 90 per cent grade, and 25c. per gal. on the pure, tank cars, f.o.b. works.

Cresylic Acid—Supplies on hand appear to be ample and this tends to unsettle the market at times as competition for business continues quite keen. Domestic producers have been more aggressive. Quotations on the 97 per cent material range from 63@68c. per gal., with the 95 per cent at 58@62c. per gal., depending upon quantity and delivery.

Naphthalene—Selling pressure continues and with business poor the market favors buyers. White flake on spot held nominally at 4¾@5c. per lb., with ball at 5¼@5¾c. per lb. White chips closed around 4@4¼c. per lb., carload basis, works. Crude to import was offered at 2c. per lb., c.i.f. New York, the quotation obtaining on good quality material.

Phenol—There was no change in the selling schedule, first hands asking 24@25c. per lb., in drums, immediate shipment. On contract it was intimated that 24c. might be shaded, but most traders were not inclined to force the market, believing that demand should soon improve.

Paranitraniline—There were sellers at prices ranging from 68@72c. per lb. Demand was dull and the undertone barely steady.

Vegetable Oils and Fats

Cottonseed Oil Futures Unsettled—Fish Oils Advance—Coconut Oil Higher—Tallow and Greases Strong

FAVORABLE crop news had some influence on oils and fats. Spot and nearby material continued firm on limited holdings, but futures were offered more freely and in numerous instances buyers held off for a lower market. Old crop cottonseed oil held at a substantial premium over new crop positions. Higher prices were paid for coconut, corn and sesame oils. Linseed oil was quite active just before crushers announced a higher selling basis. Inquiry for China wood oil improved. Soap makers were in the market for round lots of tallow and greases. Fish oils were advanced.

Cottonseed Oil—Consuming demand moderate only, but speculative trading was quite active throughout the week. With the cotton crop outlook more favorable traders were inclined to sell futures on the bulges. The setbacks, however, were not large, due mainly to the relatively firm situation in pure lard. As regards old crop oil the market was firm, supplies being well concentrated and in strong hands. Prime summer yellow oil for immediate delivery, on Thursday, closed at 14½c. asked, with winter oil, ex store, nominal at 15½@15¾c. per lb., cooperage basis. Prime summer yellow in the option market closed at 13.21c. bid for September, 12.07c. bid for October, 11.26c. bid for November and 10.90c. bid for December. Crude oil sold at 11⅝c. per lb., tank cars, mills, Southeast, immediate delivery, 10⅝c. for early September delivery and 9⅝c. for October delivery. Bleachable oil sold at 14c. per lb., tank cars, f.o.b. Chicago. Lard compound was firm at 15½@16c. per lb., in bbl., carload lots. Pure lard in Chicago closed at 13.62c. per lb., cash. Stocks of lard in the Chicago district on Aug. 1 amounted to 94,117,514 lb., which compares with 98,404,517 lb. on July 15.

Linseed Oil—Favorable crop news resulted in an easier market for flaxseed, and this, in turn, brought out an easier feeling in linseed oil on deliveries extending over the last quarter. Because of the tight supply situation crushers did not force the market on oil for delivery this side of October. About a week ago crushers announced a higher selling basis, advancing spot oil to $1.02 per gal., September to $1 per gal., October to 96c. per gal. and October-December to 94c. per gal. These prices were nominal at the close, with futures rather easy. It was reported that October forward was offered at 92c. per gal., carload lots, cooperage basis. About a week ago a linoleum maker took on 1,000 bbl. of late August and early September delivery. This business was placed at 99c. per gal., cooperage basis. The August crop report indicated a yield of 28,400,000 bu. of flaxseed, an increase of 2,500,000 bu. compared with the July estimate. Weather conditions were favorable and the good showing generally was expected. Naturally, the report was construed as bearish. September flaxseed at Duluth, on Thursday, closed at $2.33⅜, with October at $2.23⅜. Buenos Aires quoted September option flaxseed at $2.03½. Linseed cake for export was in demand and firm at $44 per ton.

China Wood Oil—There was more inquiry from consumers, but prices hardly changed. On the Pacific coast August oil was offered at 12⅞c., with September at 12½c. and October forward at 12¼c., tank cars, f.o.b. terms. In New York spot oil held at 15@15½c. per lb., in bbl.

Condition of Flaxseed Crop on Aug. 1 Raises Yield

The second preliminary report on flaxseed for this season, issued by the Department of Agriculture on Aug. 7, indicated a yield of 28,400,000 bu., which compares with 25,900,000 bu. a month ago. Weather conditions in July were favorable and the estimated yield per acre increased from 7.7 bu. to 8.4 bu.

Condition of the crop on Aug. 1, and estimated production, with a comparison, follows:

	Condition	Estimated Yield (Bu.)
*Aug., 1924	86.4	28,400,000
*July, 1924	86.8	25,900,000
Final, 1923	....	17,429,000
Final, 1922	....	10,375,000
Final, 1921	....	8,029,000

* Preliminary forecast.

Coconut Oil—Covering by shorts resulted in sales of August shipment from the Pacific coast at 9¼c. per lb., sellers' tanks, Ceylon type oil. Late August-September-October was offered at 9c. per lb., coast. In New York prompt shipment oil sold at 9⅝c. per lb., tank car basis. Copra was firm at 5⅝c., c.i.f. New York.

Corn Oil—Crude corn oil sold at 11.90c. per lb., tank cars, Chicago. For spot oil in New York, crude, in bbl., 13¼@13½c. was asked.

Palm Oils—Cables were higher, advancing Lagos for shipment from Africa to 8.20@8.25c. per lb., c.i.f. terms. Spot Lagos closed at 8¼c. Niger oil for future delivery was offered at 7.65@7.80c. per lb., depending upon the seller.

Rapeseed Oil—English refined sold at 87c. per gal., prompt delivery. Futures firm at 84@86c., as to delivery.

Sesame Oil—Refined oil afloat sold at 12⅞c. per lb., in bbl. September shipment from abroad nominal at 12½c. per lb., with offerings scanty. Demand good.

Soya Bean Oil—August shipment from the Pacific coast firm at 10½c. per lb., tank cars, duty paid.

Menhaden Oil—Sales of more than 3,000 bbl. took place at 50c. per gal., tank cars, fish factory, an advance of 5c. per gal. Fishing has improved, but with inquiry good sellers are firm in their views. Refined oil was higher in sympathy with crude.

Tallow, Etc.—Early in the week considerable business went through in extra tallow at 8¾c. per lb. Later bids were raised to 8⅞c., with holders asking from 8½@8⅝c. per lb. Oleo stearine sold at 15½c. per lb., an advance of 1c.

Miscellaneous Materials

Antimony—Market firm on smaller spot offerings. Chinese up ⅛c., closing at 8⅞@9c. per lb. Cookson's "C" grade nominal at 11⅝c. per lb. Chinese needle, lump, nominal at 8½@9c. per lb. Standard powdered needle, 200 mesh, 9@10c. per lb. White oxide, Chinese, 99 per cent, 10@11c.

Barytes—Shipments for July were about 70 per cent of normal. Inquiry fair and market steady. Water ground and floated, bleached, $23 per ton, carload lots, St. Louis. Crude, Missouri mines, $8 per ton, and Georgia mines $9 per ton.

Glycerine — With raw materials higher, and demand fair, a firm undertone prevailed for all grades. Chemically pure was advanced to 17½@18c. per lb., in drums, the inside figure obtaining on carload business. Dynamite was offered in a few instances at 16½c. per lb., in drums, f.o.b. point of production in the Middle West. Soap lye crude, basis 80 per cent, sold recently at 11¼c. per lb., loose, while 11½c. per lb. was asked late in the week. Saponification crude, basis 88 per cent, settled at 12⅞c., loose, carload lots, f.o.b. point of production.

Lithopone—Producers report keen competition for new contracts, some factors showing willingness to make slight concessions. On prompt shipment goods the market held at 6½c. per lb., in bags, carload lots. Several parcels of imported material arrived here during the week.

Naval Stores—Prices did not move much in Southern markets and this was reflected by fairly steady quotations here. Spirits of turpentine sold ex store at 84c. per gal. Rosins advanced 5@10c. per bbl., the lower grades closing nominally at $5.65@$5.75 per bbl. Export demand was quiet.

White Lead—Corroders report a satisfactory movement of pigments into consuming channels, and, with the market for pig lead in a firmer position, the prices are firmly maintained. Standard dry white lead, basic carbonate, held at 9⅞c. per lb., in casks or barrels, carload lots. On the basic sulphate 9¼c. per lb. represented the general market. No further changes took place in pig lead, leading interests holding the quotation at 7½c. per lb.

Zinc Oxide—Rubber manufacturers as well as paint makers appear to be covered for some time ahead for not much new business was placed in the past week. There was a higher market for the metal, but prices for oxide were repeated, American process, lead free, holding at 7⅞c. per lb., in bags, carload lots.

Imports at the Port of New York

August 1 to August 7

ACIDS—Hydrofluoric—3 cs., Hamburg, P. C. Kuyper & Co. **Lactic**—40 bbl., Hamburg International Acceptance Bank. **Phenol**—2 cs., Liverpool, Order. **Tartaric**—200 bbl., Bari, Superfos Co.

ALBUMEN—129 cs., hen, Shanghai, J. Lawe & Co.; 54 cs., Shanghai, Balfour, Williamson & Co.; 31 cs., Shanghai, French-American Banking Corp.; 22 cs., Tientsin, International Banking Corp.; 56 cs., Hankow, A. Klipstein & Co.; 11 cs., Hankow, Bradford Co.; 64 cs., Shanghai, Stein, Hall & Co.; 94 cs., Shanghai, French Kreme Co.; 56 cs., Taku Bar, S. W. Bridges & Co.; 22 cs., Taku Bar, Frazar & Co.; 62 cs., Taku Bar, Order.

ALIZARIN — 133 csk., Rotterdam, Grasselli Dyestuff Corp.

ANTIMONY ORE—63 bg., Delagoa Bay, Order.

ARSENIC — 200 cs., Kobe, California Trust Co.; 88 bbl., Tampico, American Metal Co.

ASBESTOS—2441 bg., Capetown, Asbestos, Ltd.; 145 bg., Port Natal, Standard Bank of South Africa.

BARIUM CHLORIDE—42 bbl., Hamburg, Brown & Roese, 87 bbl., Hamburg, Order.

BARIUM PEROXIDE—128 bbl., Hamburg, W. A. Brown.

BARYTES—590,000 kilos., Rotterdam, Ore & Chemicals Corp.

BLEACHING POWDER—165 cs., Liverpool, L. C. Dever.

BRONZE POWDER—28 cs., Bremen, Baer Bros.; 9 cs., Bremen, Order; 9 cs., Bremen, B. F. Drakenfeld & Co.

CASEIN — 170 bg., Bordeaux, T. M. Duche & Sons.

CALCIUM SULPHATE—200 bg., Marseilles, Cooper & Cooper.

CAMPHOR—200 cs., crude, Shanghai, Order; 100 cs., refined, Kobe, F. A. Cundill & Co.; 45 bbl., Hamburg, Order.

CHALK—48 bg., London, Brown Bros. & Co.

CHEMICALS—39 bbl., Rotterdam, Chaplain & Bibbo.; 518 bg., Glasgow, Brown Bros. & Co.; 280 bg., Glasgow, Coal & Iron National Bank; 1 cs., Hamburg, Elmer & Amend; 2 pkg., Hamburg, Fuchs & Lang Mfg. Co.; 20 pkg., Hamburg, Franklin Importing & Exporting Co.; 20 csk., Rotterdam, Roessler & Hasslacher Chemical Co.; 14 pkg., London, Order; 113 pkg., Hamburg, Jungmann & Co.; 21 cs., Havre, La Curto & Funk.

CHROME ORE—600 tons and a quantity in bulk, Beira, E. J. Lavino & Co.; 1,500 tons, Beira, E. J. Lavino & Co.

COLORS—8 pkg., aniline, Rotterdam, American Shipping Co.; 1,287 kegs., indigo paste, Shanghai, E. I. du Pont de Nemours Co.; 29 pkg., aniline, Havre, Ciba Co.; 23 csk., dry, Havre, Reichard-Coulston, Inc.; 3 pkg., aniline, Hamburg, H. A. Metz & Co.; 11 csk., aniline, Hamburg, Kuttroff, Pickhardt & Co.; 8 csk., aniline, Genoa, Bernard, Judae & Co.; 3 pkg., do, Hamburg, Franklin Importing & Exporting Co.; 3 csk., aniline, Rotterdam, G. W. Kuhl.; 12 csk., do, Rotterdam, Garfield Aniline Works, Inc.; 130 cs., aniline, Rotterdam, Grasselli Dyestuff Corp.; 13 pkg., do, Rotterdam, H. A. Metz & Co.; 47 pkg., do, Rotterdam, Kutroff, Pickhardt & Co.; 14 csk., aniline, Havre, Geigy Co.; 10 csk., Havre, Reichard-Coulston, Inc.

CORUNDUM ORE—1,489 bg., Delagoa Bay, Standard Bank of South Africa.

CUTCH—100 cs., Singapore, Order.

DIVI-DIVI—1,002 bg., Pampatar, Eggers & Heinlein.

DYEWOOD — 50 bl., chopped, Trieste, Order.

EPSOM SALT — 1,000 bg., Hamburg, American Commerce & Finance Corp.

FERTILIZER—665 bg., lime, Hamburg, Stumpp & Walter Co.

FERROCOBALT—4 cs., cubes, Liverpool, De Courcy, Browne & Co.

GAMBIER—100 bg., cube, Singapore, Order.

GLYCERINE—20 dr., crude, Marseilles, Order; 30 dr., crude, Hamburg, Order; 20 dr., crude, Liverpool, Order.

GRAPHITE—375 bg., Kobe, Mitsui & Co.

GUMS—77 pkg., kauri, Auckland, Irving Bank-Col. Trust Co.; 67 cs., and 242 bg., do, Auckland, Chemical National Bank; 15 cs., and 200 bg., do, Auckland, Standard Bank of South Africa; 813 bg., do, Auckland, Order; 64 bg., copal, Singapore, L. C. Gillespie & Sons; 158 cs., copal and 50 cs., damar, Baring Bros. & Co.; 128 bg., copal, Singapore, Am. Exchange National Bank; 140 bg., copal, Singapore, Order; 1,850 bg., arabic, Port Said, Order.

IRON CHLORIDE—187 bbl., Hamburg, Order.

IRON OXIDE—20 csk. red, Liverpool, Order; 50 bbl., Malaga, American-Hawaiian S.S. Co.; 450 bbl., Malaga, C. K. Williams & Co.; 172 bbl., Malaga, J. Lee Smith & Co.; 94 bbl., Malaga, Reichard-Coulston, Inc.; 75 bbl., Malaga, E. M. & F. Waldo; 228 bbl., Malaga, W. Schall & Co.; 20 bbl., Malaga, C. J. Osborn Co.; 68 bbl., Malaga, Hummel & Robinson; 65 bbl., Malaga, Order; 27 csk., Liverpool, L. H. Butcher & Co.

LITHOPONE—300 csk., Antwerp, Benjamin Moore & Co.

Opportunities in the Foreign Trade

Parties interested in any of the following opportunities may obtain all available information from the Bureau of Foreign and Domestic Commerce at Washington or from any district office of the bureau. The number placed after the opportunity must be given for the purpose of identification.

CHEMICALS, heavy, and dyes. Bahia, Brazil. Purchase and agency.—11,145.

CHEMICALS, industrial. Porto Alegre, Brazil. Agency.—11,148.

COLORS, dry for paints. Caracas, Venezuela. Agency.—11,153.

PAINTS AND VARNISHES. Rio de Janeiro, Brazil. Agency.—11,157.

PITCH. Naples, Italy. Purchase.—11,151.

PYROXYLIN SHEETS, fancy goods, and novelties. Sydney, Australia. Agency.—11,134.

ROSIN. Calcutta, India. Purchase.—11,149.

ROSIN AND TURPENTINE. Hamburg, Germany. Purchase or agency.—11,152.

CAUSTIC SODA. Bahia, Brazil. Purchase and agency.—11,145.

TURPENTINE. Goteborg, Sweden. Purchase.—11,146.

VEGETABLE OILS. Zurich, Switzerland. Agency.—11,147.

MAGNESIUM CHLORIDE — 368 dr., Hamburg, Innis, Speiden & Co.

MAGNESITE—50 bg. calcined, Trieste, Alumino Thermic Corp.; 625 bg., Rotterdam, Speiden, Whitfield Co.

MANGANESE ORE — 600 bg., Antilla, Lamson Asphalt & Chemical Co.

MANGANESE SULPHATE — 20 csk., Liverpool, Order.

NAPHTHALENE—137 bbl. flake, Hamburg, E. M. Sergeant & Co.

OCHER—50 bbl., Malaga, C. J. Osborn Co.; 24 bbl., Malaga, W. Schall & Co.

OILS—Cod—5 csk., St. Johns, R. Badcock & Co. **China Wood**—10 csk., Hankow, Toch Bros.; 300 bbl., Hankow, Viele, Blackwell & Buck; 620 bbl., Shanghai, Mitsui & Co.; 300 bbl., Shanghai, Mitsubishi Shoji Kaisha. **Coconut**—942 tons, Manila, Philippine Refining Co.; 1,098 tons, Manila, Spencer Kellogg & Sons. **Herring**—250 bbl., Kobe, National Oil Products Co. **Linseed**—100 bbl., Rotterdam, Cheesman, Elliot Co. **Olive Foots** (sulphur oil)—420 bbl., Lisbon, Heidelbach, Ickelheimer & Co.; 2 tanks, Bari, Palmolive Co. **Palm**—409 csk., Rotterdam, Order; 156 csk., Hamburg, African & Eastern Trading Co.; 576 csk., Hamburg, African & Eastern Trading Co.; 192 csk., Rotterdam, Order; 66 csk., Hamburg, Order. **Sesame**—300 bbl., Rotterdam, J. C. Francesconi & Co.; 990 bbl., Rotterdam, National City Bank; 300 bbl., Rotterdam, Order.

OIL SEEDS—Linseed—16,793 bg., Buenos Aires, Bingham & Co. **Sesame**—600 bg., Shanghai, Wah Chang Trading Co.; 1,200 bg., Shanghai, Bank of the Americas.

OLEO STEARINE — 245 pkg., London, Order; 112 pkg., Buenos Aires, Swift & Co.

PHOSPHORUS—200 cs., Antwerp, W. E. Miller.

POTASSIUM SALTS—100 kegs chlorate and 15 bbl. prussiate, Antwerp, E. Suter & Co.; 143 dr. caustic, Hamburg, Amermann & Patterson; 18 kegs prussiate, Liverpool, Order; 2 cs. caustic, Gothenburg, Baldwin Universal Co.; 1 cs. do., Gothenburg, Order; 10 csk. bicarbonate, Rotterdam, Meteor Products Co.; 50 cs. bromide, Hamburg, Order.

QUEBRACHO — 10,460 bg. extract, Buenos Aires, First National Bank of Boston; 2,044 bg. do., Buenos Aires, National Bank of Commerce; 4,954 bg. do., Buenos Aires, Order; 3,858 bg., Buenos Aires, International Products Co.

QUICKSILVER — 200 flasks, Trieste, Order; 40 flasks, Vera Cruz, Poillon & Poirier.

ROSIN—155 csk., Bordeaux, American Express Co.

SHELLAC—420 cs., Singapore, Order; 500 bg., Calcutta, Brunswick, Balke, Collender Co.; 50 cs., Hamburg, Rogers, Pyatt Shellac Co.; 150 bg., Hamburg, Ralli Bros.; 19 cs., Rotterdam, C. F. Gerlach.

SODIUM SALTS—224 cs. cyanide, Havre, International Banking Corp.; 4 cs. caustic, Gothenburg, Baldwin Universal Co.; 336 cs. cyanide, Marseilles, H. Kerge; 100 cs. bromide, Hamburg, Norvell Chemical Co.; 74 dr. cyanide, Liverpool, Order.

TAR—20 dr. birch, Hamburg, White Sea & Baltic Co.

TARTAR—184 bg., Bordeaux, Order; 90 bg., Bordeaux, Order; 179 bg., Alicante, C. Pfizer & Co.; 75 bg., Valencia, C. Pfizer & Co.; 212 bg., Rotterdam, Order.

TURMERIC—193 bg., Rotterdam, Volkart Bros.

VALONEA — 6,177 bg., Constantinople, J. A. Barkey & Co.; 4,253 bg., Smyrna, Order; 1,746 bg., Smyrna, Order.

VERMILION—10 kegs, London, Pomeroy & Fischer.

WATTLE BARK — 1,088 bg. chopped, Port Natal, Order.

WAXES—50 cs. vegetable, Kobe, Strohmeyer & Arpe; 100 cs. spermacetti, Glasgow, Order; 200 bg. paraffine, Hamburg, Equitable Trust Co.; 50 cs. vegetable, Kobe, Order; 11 bg. beeswax, Rio de Janeiro, D. Steengrafe; 51 bg. do., Rio de Janeiro, American Trading Co.; 37 bg. crude beeswax, Havana, Order.

Large Output of Sulphate of Ammonia in Germany

Reports from abroad say that the nitrogen syndicate of Berlin estimates annual production of byproduct ammonium sulphate from German coke and gas plants at from 70,000 to 75,000 metric tons of nitrogen content, or from 350,000 to 375,000 tons bulk ammonium sulphate. Coke and gas plants in the Ruhr district have been operating at nearly normal capacity since the agreement with coal operators, entered into last November. Ammonium sulphate is produced in all of the German coking plants, which account for about 85 per cent of the total production. Only the largest gas plants, producing the remaining 15 per cent are engaged in the manufacture of byproduct ammonium sulphate.

Current Prices in the New York Market

For Chemicals, Oils and Allied Products

THESE prices are for the spot market in New York City, but a special effort has been made to report American manufacturers' quotations whenever available. In many cases these are for material f.o.b. works or on a contract basis and these prices are so designated. Quotations on imported stocks are reported when they are of sufficient importance to have a material effect on the market. Prices quoted in these columns apply to large quantities in original packages.

General Chemicals

Acetone, drums, wks	lb.	$0.16 - $0.16½
Acetic anhydride, 85%, dr.	lb.	.34 - .36
Acid, acetic, 28%, bbl	100 lb.	3.12 - 3.37
Acetic, 56%, bbl	100 lb.	5.85 - 6.10
Acetic, 80%, bbl	100 lb.	8.19 - 8.44
Glacial, 99½%, bbl	100 lb.	11.01 - 11.51
Boric, bbl	lb.	.09 - .09½
Citric, kegs	lb.	.46 - .47
Formic, 85%	lb.	.12½ - .13
Gallic, tech	lb.	.45 - .50
Hydrofluoric, 52%, carboys	lb.	.11 - .12
Lactic, 44%, tech., light, bbl	lb.	.12½ - .13
22% tech., light, bbl	lb.	.06 - .06½
Muriatic, 18° tanks	100 lb.	.80 - .85
Muriatic, 20°, tanks	100 lb.	.95 - 1.00
Nitric, 36°, carboys	lb.	.04 - .04½
Nitric, 42°, carboys	lb.	.04½ - .05½
Oleum, 20%, tanks	ton	16.00 - 17.00
Oxalic, crystals, bbl	lb.	.09½ - .09¾
Phosphoric, 50% carboys	lb.	.07 - .08
Pyrogallic, resublimed	lb.	1.55 - 1.60
Sulphuric, 60°, tanks	ton	8.00 - 9.00
Sulphuric, 60°, drums	ton	12.00 - 13.00
Sulphuric, 66°, tanks	ton	13.00 - 14.00
Sulphuric, 66° drums	ton	17.00 - 18.00
Tannic, U.S.P., bbl	lb.	.65 - .70
Tannic, tech., bbl	lb.	.45 - .50
Tartaric, imp., powd., bbl.	lb.	.27 - .28
Tartaric, domestic, bbl	lb.	.29 - .30
Tungstic, per lb	lb.	1.20 - 1.25
Alcohol, butyl, drums, f.o.b. works	lb.	.30 - ....
Alcohol ethyl (Cologne spirit), bbl	gal.	4.85 - ....
Ethyl, 190 p'f. U.S.P., bbl	gal.	4.83 - ....
Alcohol, methyl (see Methanol)		
Alcohol, denatured, 190 proof		
No. 1, special bbl	gal.	.52 - ...
No. 1, 190 proof, special, dr.	gal.	.46 - ...
No. 1, 188 proof, bbl	gal.	.55 - ...
No. 1, 188 proof, dr	gal.	.49 - ...
No. 5, 188 proof, bbl	gal.	.51 - ...
No. 5, 188 proof, dr	gal.	.45 - ...
Alum, ammonia, lump, bbl	lb.	.03½ - .04
Potash, lump, bbl	lb.	.02¾ - .03¼
Chrome, lump, potash, bbl.	lb.	.05½ - .06
Aluminum sulphate, com., bags	100 lb.	1.35 - 1.40
Iron free bags	lb.	2.35 - 2.45
Aqua ammonia, 26°, drums	lb.	.06½ - .06¾
Ammonia, anhydrous, cyl	lb.	.28 - .30
Ammonium carbonate, powd. tech., casks	lb.	.12 - .13
Ammonium nitrate, tech., casks	lb.	.09 - .10
Amyl acetate tech., drums	gal.	2.50 - 2.60
Antimony oxide, white, bbl.	lb.	.09½ - .10
Arsenic, white, powd., bbl	lb.	.07½ - .08
Arsenic, red, powd., kegs	lb.	.14½ - .15½
Barium carbonate, bbl	ton	59.00 - 60.00
Barium chloride, bbl	ton	77.00 - 78.00
Barium dioxide, 88%, drums	lb.	.17½ - .18
Barium nitrate, casks	...	.08½ - .08¾
Blanc fixe, dry, bbl	lb.	.03½ - .04
Bleaching powder, f.o.b. wks., drums	100 lb.	1.90 - ....
Spot N. Y. drums	100 lb.	2.20 - 2.25
Borax, bbl	lb.	.05 - .05½
Bromine, cases	lb.	.34 - .38
Calcium acetate, bags	100 lb.	3.00 - 3.05
Calcium arsenate, dr	lb.	.09 - .09½
Calcium carbide, drums	lb.	.05 - .05½
Calcium chloride, fused, dr. wks.	ton	21.00 - ....
Gran. drums works	ton	27.00 - ....
Calcium phosphate, mono, bbl	lb.	.06½ - .07½
Camphor, Jap. cases	lb.	.68 - .69
Carbon bisulphide, drums	lb.	.06 - .06½
Carbon tetrachloride, drums	lb.	.06½ - .07
Chalk, precip.—domestic, light, bbl	lb.	.04½ - .04¾
Domestic, heavy, bbl	lb.	.03½ - .04
Imported, light, bbl	lb.	.04½ - .05
Chlorine, liquid, tanks, wks.	lb.	.04½ - ....
Contract, tanks, wks	lb.	.04½ - ....
Cylinders, 100 lb., wks	lb.	.05½ - .07½
Chloroform, tech., drums	lb.	.30 - .32
Cobalt, oxide, bbl	lb.	2.10 - 2.25
Copperas, bulk, f.o.b. wks	ton	15.00 - 16.00
Copper carbonate, bbl	lb.	.17 - .17½
Copper cyanide, drums	lb.	.45 - .46
Copper oxide, kegs	lb.	.16 - .16½
Coppersulphate, dom., bbl.	100 lb.	4.50 - 4.60
Imp bbl	100 lb.	4.50 - ....
Cream of tartar bbl	lb.	.20½ - .21
Epsom salt, dom., tech., bbl	100 lb.	1.75 - 2.00
Epsom salt, imp., tech., bags	100 lb.	1.30 - 1.35
Epsom salt, U.S.P., dom., bbl	100 lb.	2.10 - 2.35
Ether, U.S.P., dr concent'd	lb.	.13 - .14
Ethyl acetate, 85%, drums	gal.	.92 - .95
Ethyl acetate, 99%, dr	gal.	$1.08 - $1.10
Formaldehyde, 40%, bbl	lb.	.09 - .09½
Fullers earth—f.o.b. mines	ton	7.50 - 18.00
Furfural, works, bbl	lb.	.25 - ....
Fusel oil, ref., drums	gal.	2.75 - 3.50
Fusel oil, crude, drums	gal.	1.50 - 1.75
Glaubers salt, wks., bags	100 lb.	1.20 - 1.40
Glaubers salt, imp., bags	100 lb.	.90 - .92
Glycerine, c.p., drums extra	lb.	.17½ - .17¾
Glycerine, dynamite, drums	lb.	.16½ - ....
Glycerine, crude 80%, loose	lb.	.11½ - ....
Hexamethylene, drums	lb.	.65 - .70
Lead:		
White, basic carbonate, dry, casks	lb.	.09¼ - ....
White, basic sulphate, casks	lb.	.09¼ - ....
White, in oil, kegs	lb.	.11¾ - .12½
Red, dry, casks	lb.	.10½ - ....
Red, in oil, kegs	lb.	.12¼ - .13¼
Lead acetate, white crys., bbl.	lb.	.14½ - ....
Brown, broken, casks	lb.	.13½ - ....
Lead arsenate, powd., bbl	lb.	.16 - .18
Lime-Hydrated, bg, wks	ton	10.50 - 12.50
Bbl., wks	ton	18.00 - 19.00
Lime, Lump, bbl	280 lb.	3.63 - 3.65
Litharge, comm., casks	lb.	.10 - .10½
Lithopone, bags	lb.	.06½ - .06¾
Magnesium carb., tech., bags	lb.	.08½ - .08¾
Methanol, 95%, bbl	gal.	.74 - .76
Methanol, 97%, bbl	gal.	.76 - .78
Methanol, pure, tanks	gal.	.75 - ....
drums	gal.	.78 - .80
bbl	gal.	.83 - .85
Methyl-acetone, t'ks	gal.	.70 - ....
Nickel salt, double, bbl	lb.	.09 - .10½
Nickel salts, single, bbl	lb.	.10 - .11
Orange mineral, csk	lb.	.13½ - .14½
Phosgene	...	.60 - .75
Phosphorus, red, cases	lb.	.70 - .75
Phosphorus, yellow, cases	lb.	.37½ - .40
Potassium bichromate, casks	lb.	.09 - .09½
Potassium bromide, gran., bbl	lb.	.25 - .38
Potassium carbonate, 80-85%, calcined, casks	lb.	.05¼ - .05½
Potassium chlorate, powd	lb.	.07½ - .08½
Potassium cyanide, drums	lb.	.47 - .52
Potassium, first sorts, cask	lb.	.07¾ - .08
Potassium hydroxide (caustic potash) drums	lb.	.06½ - .06¾
Potassium iodide, cases	lb.	3.65 - 3.75
Potassium nitrate, bbl	lb.	.06 - .07½
Potassium permanganate, drums	lb.	.13¾ - .14
Potassium prussiate, red, casks	lb.	.35 - .38
Potassium prussiate, yellow, casks	lb.	.18 - .18½
Salammoniac, white, gran., casks, imported	lb.	.06½ - .06¾
Salammoniac, white, gran., bbl., domestic	lb.	.07½ - .08
Gray, gran., casks	lb.	.08 - .09
Salsoda, bbl	100 lb.	1.20 - 1.40
Salt cake (bulk) works	ton	16.00 - 18.00
Soda ash, light, 58% flat, bulk, contract	100 lb.	1.25 - ....
bags, contract	100 lb.	1.38 - ....
Soda ash, dense, bulk, contract, basis 58%	100 lb.	1.35 - ....
bags, contract	100 lb.	1.45 - ....
Soda, caustic, 76%, solid, drums contract	100 lb.	3.10 - ....
Soda, caustic, ground and flake, contracts, dr	100 lb.	3.50 - 3.85
Soda, caustic, solid, 76% f. a. s. N. Y.	100 lb.	2.85 - 3.05
Sodium acetate, works, bbl	lb.	.04½ - .05
Sodium bicarbonate, bulk	100 lb.	1.75 - ....
330-lb. bbl	100 lb.	2.00 - ....
Sodium bichromate, casks	lb.	.07 - .07½
Sodium bisulphate (niter cake)	ton	6.00 - 7.00
Sodium bisulphite, powd., U.S.P., bbl	lb.	.04½ - .04¾
Sodium chlorate, kegs	lb.	.06½ - .07
Sodium chloride	long ton	12.00 - 13.00
Sodium cyanide, cases	lb.	.19 - .22
Sodium fluoride, bbl	lb.	$0.08½ - $0.09
Sodium hyposulphite, bbl	lb.	.02½ - .02¾
Sodium nitrite, casks	lb.	.08½ - .09
Sodium peroxide, powd., cases	lb.	.23 - .27
Sodium phosphate, dibasic, bbl	lb.	.03½ - .03¾
Sodium prussiate, yel. bbl	lb.	.09½ - .10½
Sodium salicylic, drums	lb.	.38 - .40
Sodium silicate (40°, drums)	100 lb.	.75 - 1.15
Sodium silicate (60°, drums)	100 lb.	1.75 - 2.00
Sodium sulphide, fused, 60-62% drums	lb.	.03½ - .03¾
Sodium sulphite, crys., bbl	lb.	.02½ - .03
Strontium nitrate, powd., bbl.	lb.	.09¾ - .10
Sulphur chloride, yel drums	lb.	.04½ - .05
Sulphur, crude	ton	18.00 - 20.00
At mine, bulk	ton	16.00 - 18.00
Sulphur, flour, bag	100 lb.	2.25 - 2.35
Sulphur, roll, bag	100 lb.	2.00 - 2.10
Sulphur dioxide, liquid, cyl	lb.	.08 - .08
Tin bichloride, bbl	lb.	.14 - ....
Tin oxide, bbl	lb.	.52 - ....
Tin crystals, bbl	lb.	.35½ - ....
Zinc carbonate, bags	lb.	.12 - .14
Zinc chloride, gran, bbl	lb.	.06 - .07½
Zinc cyanide, drums	lb.	.36½ - .37
Zinc dust, bbl	lb.	.08 - .08½
Zinc oxide, lead free, bag	lb.	.07½ - ....
5% lead sulphate bags	lb.	.06½ - ....
10 to 35 % lead sulphate, bags	lb.	.06½ - ....
French, red seal, bags	lb.	.09½ - ....
French, green seal, bags	lb.	.10½ - ....
French, white seal, bbl	lb.	.11½ - ....
Zinc sulphate, bbl	100 lb.	3.00 - 3.25

Coal-Tar Products

Alpha-naphthol, crude, bbl	lb.	$0.60 - $0.65
Alpha-naphthol, ref., bbl	lb.	.65 - .75
Alpha-naphthylamine, bbl	lb.	.35 - .36
Aniline oil, drums	lb.	.16 - .16½
Aniline salt, bbl.	lb.	.22 - .23
Anthracene, 80%, drums	lb.	.70 - .75
Anthraquinone, 25%, paste, drums	lb.	.75 - .80
Benzaldehyde U.S.P., carboys	lb.	1.50 - ....
f.f.c. drums	lb.	1.60 - ....
tech, drums	lb.	68 - .72
Benzene, pure, water-white, tanks, works	gal.	.25 - ....
Benzene, 90%, tanks, works	gal.	.23 - ....
Benzidine base, bbl	lb.	.80 - .82
Benzidine sulphate, bbl	lb.	.70 - .72
Benzoic acid, U.S.P., kegs	lb.	.75 - .85
Benzoate of soda, U.S.P., bbl.	lb.	.65 - .70
Benzyl chloride, 95-97%, ref. carboys	lb.	.35 - ....
Benzyl chloride, tech., drums	lb.	.25 - ....
Beta-naphthol, tech., bbl	lb.	.24 - .25
Beta-naphthylamine, tech	lb.	.65 - .70
Cresol, U.S.P., drums	lb.	.22 - .26
Ortho-cresol, drums	lb.	.28 - .32
Cresylic acid, 97%, works drums	gal.	.63 - .65
95-97%, drums, works	gal.	.58 - .60
Dichlorbenzene, drums	lb.	.07 - .08
Diethylaniline, drums	lb.	.53 - .58
Dimethylaniline, drums	lb.	.35 - .37
Dinitrobenzene, bbl	lb.	.15 - .17
Dinitrochlorbenzene, bbl	lb.	.21 - .22
Dinitronaphthalen, bbl	lb.	.30 - .32
Dinitrophenol, bbl	lb.	.35 - .40
Dinitrotoluen, bbl	lb.	.18 - .20
Dip oil, 25%, drums	gal.	.26 - .28
Diphenylamine, bbl	lb.	.48 - .50
H-acid, bbl	lb.	.72 - .75
Meta-phenylenediamine, bbl.	lb.	.95 - 1.00
Michlers ketone, bbl	lb.	3.00 - 3.25
Monochlorbenzene, drums	lb.	.08 - .10
Monoethylaniline, drums	lb.	1.20 - 1.30
Naphthalene, flake, bbl	lb.	.04½ - .05¼
Naphthalene, balls, bbl	lb.	.05½ - .05¾
Naphthionate of soda, bbl	lb.	.60 - .65
Naphthionic acid, crude, bbl.	lb.	.60 - .62
Nitrobenzene, drums	lb.	.09 - .09½
Nitro-naphthalene, bbl	lb.	.25 - .30
Nitro-toluene, drums	lb.	.13½ - .14
N-W acid, bbl	lb.	.95 - 1.00
Ortho-amidophenol, kegs	lb.	2.40 - 2.50
Ortho-dichlorbenzene, drums	lb.	.12 - .13
Ortho-nitrophenol, bbl	lb.	.95 - 1.00
Ortho-nitrotoluene, drums	lb.	.11 - .12
Ortho-toluidine, bbl	lb.	.13 - .14
Para-aminophenol, base, kegs	lb.	1.20 - 1.25
Para-aminophenol, HCl, kegs	lb.	1.30 - 1.40
Para-dichlorbenzene, bbl	lb.	.17 - .20
Paranitraniline, bbl	lb.	.68 - .70
Para-nitrotoluene, bbl	lb.	.50 - .55
Para-phenylenediamine, bbl.	lb.	1.35 - 1.45
Para-toluidine, bbl	lb.	.75 - .80
Phthalic anhydride, bbl	lb.	.30 - .34
Phenol, U.S.P., dr	lb.	.24 - .26
Picric acid, bbl	lb.	.20 - .22
Pitch, tanks, works	ton	27.00 - 30.00
Pyridine, imp., drums	gal.	3.80 - 4.00
Resorcinol, tech., kegs	lb.	1.30 - 1.40

Resorcinol, pure, kegs	lb.	$2.00 – $2.25
R-salt, bbl	lb.	.50 – .55
Salicylic acid, tech., bbl	lb.	.32 – .33
Salicylic acid, U.S.P., bbl	lb.	.35 – ....
Solvent naphtha, water-white, tanks	gal.	.25 – ....
Crude, tanks	gal.	.22 – ....
Sulphanilic acid, crude, bbl	lb.	.16 – .18
Tolidine, bbl	lb.	1.00 – 1.05
Toluidine, mixed, kegs	lb.	.30 – .55
Toluene, tank cars, works	gal.	.26 – ....
Toluene, drums, works	gal.	.30 – ....
Xylidine, drums	lb.	.45 – .48
Xylene, 5 deg.-tanks	gal.	.40 – ....
Xylene, com., tanks	gal.	.28 – ....

Naval Stores

Rosin B-D, bbl	280 lb.	$5.65 – $5.75
Rosin E-I, bbl	280 lb.	5.75 – 5.85
Rosin K-N, bbl	280 lb.	6.00 – 6.25
Rosin W.G.-W.W., bbl	280 lb.	7.10 – 7.65
Wood rosin, bbl	280 lb.	5.40 – 5.50
Turpentine, spirits of, bbl	gal.	.84 – ....
Wood, steam dist., bbl	gal.	.72 – ....
Wood, dest. dist., bbl	gal.	.54 – .55
Pine tar pitch, bbl	200 lb.	5.50 – ....
Tar, kiln burned, bbl	500 lb.	10.50 – ....
Retort tar, bbl	500 lb.	10.50 – ....
Rosin oil, first run, bbl	gal.	.38 – ....
Rosin oil, second run, bbl	gal.	.43 – ....
Rosin oil, third run, bbl	gal.	.48 – ....
Pine oil, steam dist.	gal.	.60 – ....
Pine tar oil, com'l	gal.	.30 – ....

Animal Oils and Fats

Degras, bbl	lb.	$0.03½ – $0.05½
Grease, yellow, loose	lb.	.07½ – .07¾
Lard oil, Extra No. 1, bbl	gal.	.84 – .85
Lard compound, bbl	lb.	.15½ – .15¾
Neatsfoot oil 20 deg. bbl	gal.	1.28 – ....
No. 1, bbl	gal.	.82 – .84
Oleo Stearine		.15½ – ....
Oleo oil, No. 1, bbl	lb.	.15½ – ....
Red oil, distilled, d.p. bbl	lb.	.09 – .09½
Saponified, bbl	lb.	.09 – .09½
Tallow, extra, loose works	lb.	.08½ – ....
Tallow oil, acidless, bbl	gal.	.84 – .86

Vegetable Oils

Castor oil, No. 3, bbl	lb.	$0.16½ – ......
Castor oil, No. 1, bbl	lb.	.17 – ......
Chinawood oil, bbl	lb.	.14½ – .15½
Coconut oil, Ceylon, bbl	lb.	.10½ – ......
Ceylon, tanks, N.Y.	lb.	.09½ – ......
Coconut oil, Cochin, bbl	lb.	.10½ – .11
Corn oil, crude, bbl	lb.	.13½ – .13¾
Crude, tanks, (f.o.b. mill)	lb.	.12 – ......
Cottonseed oil, crude (f.o.b. mill), tanks	lb.	.11½ – .11¾
Summer yellow, bbl	lb.	.14½ – .15
Winter yellow, bbl	lb.	.15½ – .16
Linseed oil, raw, car lots, bbl.	gal.	1.02 – ....
Raw, tank cars (dom.)	gal.	.96 – ....
Boiled, cars, bbl. (dom.)	gal.	1.04 – ....
Olive oil, denatured, bbl	gal.	1.15 – 1.20
Sulphur, (foots) bbl	lb.	.09½ – .09¾
Palm, Lagos, casks	lb.	.08½ – .08¾
Niger, casks	lb.	.07½ – .08
Palm kernel, bbl	lb.	.09½ – ....
Peanut oil, crude, tanks (mill)	lb.	.12½ – .13
Peanut oil, refined, bbl	lb.	.16½ – .17
Perilla, bbl	lb.	.13 – .13½
Rapeseed oil, refined, bbl	gal.	.87 – ....
Sesame, bbl	lb.	.13 – .13½
Soya bean (Manchurian), bbl.	lb.	.11½ – .11¾
Tank, f.o.b. Pacific coast	lb.	.10½ – ....
Tank, (f.o.b. N.Y.)	lb.	.10½ – ....

Fish Oils

Cod, Newfoundland, bbl	gal.	$0.58 – $0.60
Menhaden, light pressed, bbl.	gal.	.60 – ....
White bleached, bbl	gal.	.62 – ....
Blown, bbl	gal.	.64 – ....
Crude, tanks (f.o.b. factory)	gal.	.50 – ....
Whale No. 1 crude, tanks, coast	lb.	....
Winter, natural, bbl	gal.	.75 – .76
Winter, bleached, bbl	gal.	.78 – .79

Oil Cake and Meal

Coconut cake, bags	ton	$33.00 – 34.00
Cottonseed meal, f.o.b. mills	ton	43.00 – ......
Linseed cake, bags	ton	44.00 – ......
Linseed meal, bags, spot	ton	46.00 – ......

Dye & Tanning Materials

Albumen, blood, bbl	lb.	$0.50 – $0.55
Albumen, egg, tech, kegs	lb.	.95 – .97
Cochineal, bags	lb.	.33 – .35
Cutch, Borneo, bales	lb.	.04½ – .04¾
Cutch, Rangoon, bales	lb.	.13½ – .14½
Dextrine, corn, bags	100 lb.	4.52 – 4.57
Dextrine, gum, bags	100 lb.	4.82 – 5.09
Divi-divi, bags	ton	40.00 – 42.00
Fustic, sticks	ton	30.00 – 35.00
Fustic, chips, bags	lb.	.04 – .05
Gambier com., bags	lb.	.12½ – .13
Logwood, sticks	ton	25.00 – 26.00
Logwood, chips, bags	lb.	.02½ – .03
Sumac, leaves, Sicily, bags	ton	125.00 – 130.00
Sumac, ground, bags	ton	123.00 – ......
Sumac, domestic, bags	ton	50.00 – 55.00
Starch, corn, bags	100 lb.	3.87 – 4.08
Tapioca flour, bags	lb.	.04½ – .06

Extracts

Archil, conc., bbl	lb.	$0.16 – $0.19
Chestnut, 25% tannin, tanks.	lb.	.01½ – .02
Divi-divi, 25% tannin, bbl	lb.	.05 – .05½
Fustic, crystals, bbl	lb.	.20 – .22
Fustic, liquid, 42°, bbl	lb.	.08 – .09
Gambier, liq., 25% tannin, bbl.	lb.	.11 – .11½
Hematine crys., bbl	lb.	.14 – .18
Hemlock, 25% tannin, bbl	lb.	.03½ – .04
Hypernic, solid, drums	lb.	.22 – .24
Hypernic, liquid, 51°, bbl	lb.	.12 – .13
Logwood, crys., bbl	lb.	.14 – .15
Logwood, liq., 51°, bbl	lb.	.07½ – .08½
Osage Orange, 51°, liquid, bbl.	lb.	.07 – .08
Osage Orange, powder, bg	lb.	.14 – .15
Quebracho, solid, 65% tannin, bbl	lb.	.04½ – .04¾
Sumac, dom., 51°, bbl	lb.	.06½ – .06¾

Dry Colors

Blacks–Carbongas, bags, f.o.b. works, contract	lb.	$0.09 – $0.11
spot, cases	lb.	.12 – .16
Lampblack, bbl	lb.	.12 – .40
Mineral, bulk	ton	35.00 – 45.00
Blues–Bronze, bbl	lb.	.36 – .38
Prussian, bbl	lb.	.36 – .38
Ultramarine, bbl	lb.	.07 – .35
Browns, Sienna, Ital., bbl	lb.	.05 – .12
Sienna, Domestic, bbl	lb.	.03 – .03½
Umber, Turkey, bbl	lb.	.04 – .04½
Greens–Chrome, C.P. Light, bbl	lb.	.28 – .30
Chrome, commercial, bbl	lb.	.11 – .11½
Paris, bulk	lb.	.24 – .26
Reds, Carmine No. 40, tins	lb.	4.25 – 4.50
Iron oxide red, casks	lb.	.08 – .12
Para toner, kegs	lb.	.95 – 1.00
Vermilion, English, bbl	lb.	1.30 – 1.35
Yellow, Chrome, C.P. bbls	lb.	.17 – .17½
Ocher, French, casks	lb.	.02 – .03

Waxes

Bayberry, bbl	lb.	$0.21 – $0.21½
Beeswax, crude, Afr. bg	lb.	.25 – .26
Beeswax, refined, light, bags	lb.	.32 – .34
Beeswax, pure white, cases	lb.	.40 – .41
Candellila, bags	lb.	.23 – .23½
Carnauba, No. 1, bags	lb.	.36 – .37
No. 2, North Country, bags	lb.	.28 – .29
No. 3, North Country, bags	lb.	.21 – .22
Japan, cases	lb.	.18½ – .19
Montan, crude, bags	lb.	.05½ – .06
Paraffine, crude, match, 105-110 m.p., bbl	lb.	.05½ – ....
Crude, scale 124-126 m.p. bags	lb.	.04½ – .05
Ref., 118-120 m.p., bags	lb.	.05½ – ....
Ref., 123-125 m.p., bags	lb.	.05½ – ....
Ref, 128-130 m.p., bags	lb.	.05¾ – ....
Ref., 133-135 m.p., bags	lb.	.06½ – .07
Ref., 135-137 m.p., bags	lb.	.07½ – .07½
Stearic acid, sgle pressed, bags	lb.	.11 – ....
Double pressed, bags	lb.	.11½ – ....
Triple pressed, bags	lb.	.12½ – ....

Fertilizers

Acid phosphate, 16%, bulk, works	ton	$7.50 – $7.75
Ammonium sulphate, bulk f.o.b. works	100 lb.	2.40 – 2.45
Blood, dried, bulk	unit	4.10 – 4.15
Bone, raw, 3 and 50, ground	ton	26.00 – 28.00
Fish scrap, dom., dried, wks.	unit	3.50 – ....
Nitrate of soda, bags	100 lb.	2.47 – ....
Tankage, high grade, f.o.b. Chicago	unit	2.50 – ....
Phosphate rock, f.o.b. mines		
Florida pebble, 68-72%	ton	3.25 – 3.70
Tennessee, 75%	ton	6.75 – 7.00
Potassium muriate, 80%, bags	ton	34.55 – ....
Potassium sulphate, bags basis 90%	ton	45.85 – ....
Double manure salt	ton	26.35 – ....
Kainit	ton	7.22 – ....

Crude Rubber

Para—Upriver fine	lb.	$0.24½ – ....
Upriver coarse	lb.	.17½ – ....
Upriver caucho ball	lb.	.16½ – ....
Plantation—First latex crepe	lb.	.26½ – ....
Ribbed smoked sheets	lb.	.25½ – ....
Amber crepe No. 1	lb.	.25½ – ....

Gums

Copal, Congo, amber, bags	lb.	$0.09 – $0.14
East Indian, bold, bags	lb.	.13 – .14
Manila, pale, bags	lb.	.18 – .19
Pontinak, No. 1 bags	lb.	.19 – .20
Damar, Batavia, cases	lb.	.23 – .23½
Singapore, No. 1, cases	lb.	.26 – .26½
Singapore, No. 2, cases	lb.	.18 – .18½
Kauri, No. 1, cases	lb	.58 – .64
Ordinary chips, cases	lb.	.21 – .22
Manjak, Barbados, bags	lb.	.06 – .09

Shellac

Shellac, orange fine, bags	lb.	$0.54 – $0.55
Orange superfine, bags	lb.	.56 – .57
A. C. garnet, bags	lb.	.52 – ....
Bleached, bonedry	lb.	.63 – .64
Bleached, fresh	lb.	.52 – .53
T. N., bags	lb.	.52 – .53

Miscellaneous Materials

Asbestos, crude No. 1 f.o.b., Quebec	sh. ton	$300.00 – $400.00
Asbestos, shingle, f.o.b., Quebec	sh. ton	50.00 – 70.00
Asbestos, cement, f.o.b., Quebec	sh. ton	20.00 – 25.00
Barytes, grd., white, f.o.b. mills, bbl	net ton	16.00 – 17.00
Barytes, grd., off-color, f.o.b. Balt.	net ton	13.00 – 14.00
Barytes, floated, f.o.b. St. Louis, bbl	net ton	23.00 – 24.00
Barytes, crude f.o.b. mines, bulk	net ton	8.00 – 9.00
Casein, bbl., tech	lb.	.11 – .12
China clay (kaolin) crude, No. 1, f.o.b. Ga.	net ton	7.00 – 8.00
Washed, f.o.b. Ga.	net ton	8.50 – 9.00
Powd., f.o.b. Ga.	net ton	14.00 – 20.00
Crude f.o.b. Va.	net ton	6.00 – 8.00
Ground, f.o.b. Va.	net ton	13.00 – 19.00
Imp., lump, bulk	net ton	15.00 – 20.00
Imp., powd	net ton	45.00 – 50.00
Feldspar, No. 1 f.o.b. N.C.	long ton	6.50 – 7.25
No. 2 f.o.b. N.C.	long ton	4.50 – 5.00
No. 1 gr'd. N. C.	long ton	15.32 – 21.00
No. 1 Canadian, f.o.b. mill, powd	long ton	20.00 – ....
Graphite, Ceylon, lump, first quality, bbl	lb.	.05½ – .06
Ceylon, chip, bbl	lb.	.04½ – .05
High grade amorphous crude	ton	15.00 – 35.00
Gum arabic, amber, sorts, bags	lb.	.11½ – .11¾
Gum tragacanth, sorts, bags	lb.	.50 – .51
No. 1, bags	lb.	1.20 – ....
Kieselguhr, f.o.b. Cal.	ton	40.00 – 42.00
F.o.b. N. Y.	ton	50.00 – 55.00
Magnesite, calcined, f.o.b. Cal.	ton	35.00 – 45.00
Pumice stone, imp., casks	lb.	.03 – .40
Dom., lump, bbl	lb.	.06 – .08
Dom., ground, bbl	lb.	.03 – .05
Silica, glass sand, f.o.b. Ind.	ton	2.00 – 2.25
Silica, sand blast, f.o.b. Ind.	ton	2.25 3.50
Silica, amorphous, 200-mesh, f.o.b. Ill.	ton	20.00 – ....
Silica, glass sand, f.o.b. Ill.	ton	2.00 – 2.50
Soapstone, coarse, f.o.b. Vt., bags	ton	7.50 – 8.00
Talc, 200 mesh, f.o.b., Vt., bags, extra	ton	10.50 – ....
Talc, 200 mesh, f.o.b. Ga., bags	ton	9.50 – 10.00
Talc, 325 mesh, f.o.b. New York, grade A bags	ton	14.75 – ....

Mineral Oils

Crude, at Wells

Pennsylvania	bbl.	$2.75 – $3.00
Corning	bbl.	1.75 – ......
Cabell	bbl.	1.45 – .....
Somerset	bbl.	1.55 – ......
Illinois	bbl.	1.62 – ......
Indiana	bbl.	1.63 – ......
Kansas and Okla. under 28 deg.	bbl.	.90 – ......
California, 35 deg. and up	bbl.	1.40 – ......

Gasoline, Etc.

Motor gasoline steel bbls	gal.	$0.19 – ......
Naphtha, V. M. & P. deod, steel bbls	gal	.18 – ......
Kerosene, ref. tank wagon	gal.	.13 – ......
Bulk, W.W. delivered, N.Y.	gal.	.07½ – .07½
Lubricating oils:		
Cylinder, Penn., filtered	gal.	.29 – .32
Bloomless, 30@31 grav.	gal.	.20 – .21
Paraffin, pale 885 vis.	gal.	.15½ – .16½
Spindle, 200, pale	gal.	.21 – .21½
Petrolatum, amber, bbls	lb.	.04 – .04½
Paraffine wax (see waxes)		

Refractories

Bauxite brick, 56% Al_2O_3, f.o.b. Pittsburgh	1,000	$140–$145
Chrome brick, f.o.b. Eastern shipping points	ton	50–..
Chrome cement, 40-50% Cr_2O_3	ton	23–27
40-45% Cr_2O_3, sacks, f.o.b. Eastern shipping points	ton	23.00
Fireclay brick, 1st. quality, 9-in. shapes, f.o.b. Ky. wks.	1,000	42–45
2nd. quality, 9-in. shapes, f.o.b. wks.	1,000	35–38
Magnesite brick, 9-in. straight (f.o.b. wks.)	ton	65–68
9-in. arches, wedges and keys	ton	80–85
Scraps and splits	ton	85
Silica brick, 9-in. sizes, f.o.b. Chicago district	1,000	48–50
Silica brick, 9-in. sizes, f.o.b. Birmingham district	1,000	48–50
F.o.b. Mt. Union, Pa.	1,000	38–39
Silicon carbide refract. brick, 9-in.	1,000	1,180.00

Ferro-Alloys

Ferrotitanium, 15-18% f.o.b. Niagara Falls, N.Y.	ton	$200.00 – ......

Ferrochromium, per lb. of Cr, 1-2% C	lb.	$0 30 –	....
4-6% C	lb.	.12½–	....
Ferromanganese, 78-82% Mn, Atlantic seabd. duty paid	gr.ton	100.00 –	....
Spiegeleisen, 19-21% Mn.	gr.ton	35.00 –	36.00
Ferromolybdenum, 50-60% Mo, per lb. Mo.	lb.	2.00 –	2.25
Ferrosilicon, 10-12%	gr.ton	39.50 –	43.50
50%	gr.ton	72.00 –	75 00
Ferrotungsten, 70-80% per lb. of W	lb.	.90 –	.93
Ferro-uranium, 35-50%, of U, per lb. of U	lb.	4.50 –	....
Ferrovanadium, 30-40%, per lb. of V	lb.	3.25 –	3 75

Ores and Semi-finished Products

Bauxite, dom. crushed, dried, f.o.b. shipping points	ton	$5.50 –	$8.75
Chrome ore, Calif. concentrates, 50% min. Cr_2O_3.	ton	22.00 –	....
C.i.f. Atlantic seaboard	ton	18 50 –	24.00
Coke, fdry., f.o.b. ovens	ton	4.25 –	4 50
Coke, furnace, f.o.b. ovens	ton	3.00 –	3.25
Fluorspar, gravel, f.o.b. mines, Illinois	ton	22.00 –	23 50
Ilmenite, 52% TiO_2 Va.	lb.	.01¼–	....
Manganese ore, 50% Mn, c.i.f. Atlantic seaport	unit	.42 –	.45
Manganese ore, chemical (MnO_2)	ton	75.00 –	80.00
Molybdenite 85% MoS_2, per lb. MoS_2, N. Y.	lb.	.80 –	....
Monazite, per unit of ThO_2, c.i.f., Atl. seaport	lb.	.06 –	.08
Pyrites, Span., fines, c.i.f. Atl. seaport	unit	.11½–	.12
Pyrites, Span., furnace size, c.i.f. Atl. seaport	unit	.12 –	....
Pyrites, dom. fines, f.o.b. mines, Ga.	unit	.12 –	....
Rutile, 94@96% TiO_2	lb.	.12 –	.15
Tungsten, scheelite, 60% WO_3 and over	unit	9.25 –	....
Tungsen, wolframite, white, 60% WO_3	unit	9.00 –	9.25
Uranium ore (carnotite) per lb. of U_3O_8	lb.	3.50 –	3.75
Uranium oxide, 96% per lb. U_3O_8	lb.	12.25 –	12.50
Vanadium pentoxide, 99%	lb.	2.50 –	4.00
Vanadium ore, per lb. V_2O_5	lb.	1.00 –	1.25
Zircon, 99%	lb.	.06 –	.07

Non-Ferrous Metals

Copper, electrolytic	lb.	$0.13⅛– .13½
Aluminum, 98 to 99%	lb	.26½– .28
Antimony, wholesale, Chinese and Japanese	lb.	.08¾– .09
Nickel, 99%	lb.	.27 – .30
Monel metal, shot and blocks	lb.	.32
Tin, 5-ton lots, Straits	lb.	.51⅞
Lead, New York, spot	lb.	.07¼
Lead, E. St. Louis, spot	lb.	.0735
Zinc, spot, New York	lb.	.0650
Zinc, spot, E. St. Louis	lb.	.0615
Silver (commercial)	oz.	.68⅜
Cadmium	lb.	.60
Bismuth (508 lb. lots)	lb.	2.40
Cobalt	lb.	2.50–3.00
Magnesium, ingots, 99%	lb.	.90–.95
Platinum, refined	oz.	120.00
Iridium	oz.	260.00–270.00
Palladium, refined	oz.	78.00–83.00
Mercury	75 lb.	72.50–73.00
Tungsten powder	lb	.95–1.00

Finished Metal Products

	Warehouse Price Cents per Lb.
Copper sheets, hot rolled	19.00
Copper bottoms	28.75
Copper rods	19.50
High brass rods	16.75
High brass rods	14.50
Low brass wire	19.00
Low brass rods	19.50
Brazed bronze tubing	24.25
Seamless copper tubing	22.25
Seamless high brass tubing	21.00

OLD METALS—The following are the dealers purchasing prices in cents per pound:

Copper, heavy and crucible	10.75 @ 11 00
Copper, heavy and wire	10.25 @ 10.37½
Copper, light and bottoms	8.50 @ 8.75
Lead, heavy	6.00 @ 6 12½
Lead, tea	3.50 @ 3 62½
Brass, heavy	5.50 @ 6 00
Brass, light	5.00 @ 5.25
No. 1 yellow brass turnings	6.75 @ 7.25
Zinc scrap	4.00 @ 4.25

Structural Material

The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses in the cities named:

	New York	Chicago
Structural shapes	$3.34	$3.34
Soft steel bars	3.24	3.24
Soft steel bar shapes	3.54	3.54
Soft steel bands	4.09	4 09
Plates, ¼ to 1 in. thick	3 34	3.34

Industrial

Financial, Construction and Manufacturing News

Construction and Operation

Alabama

BIRMINGHAM—The Standard Gas Products Co. of Alabama, Inc., is reported to be perfecting plans for the initial unit of its proposed local plant for the production of acetylene gas and kindred products, with estimated cost placed in excess of $45,000, including equipment.

Arkansas

LITTLE ROCK—The Southern Paint Works, Inc., has tentative plans under advisement for the rebuilding of the portion of its plant destroyed by fire, July 22, with loss estimated at close to $50,000, including machinery.

California

GIANT—The Giant Powder Co., First National Bank Bldg., San Francisco, has commenced the construction of a new local plant for the manufacture of black powder, etc., to consist of a number of buildings, estimated to cost in excess of $200,000, with equipment. The company has a tract of 200 acres for the works.

LOS ANGELES—The Julian Oil Corp., Los Angeles, with headquarters at 512 5th Ave., New York, operating local oil properties, has plans under way for the erection of a new refining plant in this same district. Extensions and improvements will be made also in present storage and distributing works, and additional such plants erected. The company is disposing of a preferred stock issue if $5,000,000, a considerable portion of the fund to be used for the expansion. C. C. Julian is president.

LONG BEACH—The Southern California Specialty Glass Mfg. Co., recently organized, has acquired a tract of 3 acres of land in the Signal Hill section, as a site for a new plant for the manufacture of table glassware, lighting globes, etc. It will consist of a number of units, work on the first buildings to be started at an early date. The complete plant is estimated to cost $450,000, with machinery. H. A. Schnelbach is president and general manager; and H. R. Fay, secretary and treasurer. The last noted is also secretary of the Long Beach Chamber of Commerce.

TAFT—The Pacific Gasoline Co., has commenced the construction of a new gasoline works on the Bakersfield-Taft Highway, consisting of gas compressor and absorption units, estimated to cost $150,000, with machinery.

BERKELEY—The California Ink Co., Camelia and 3rd Sts., Berkeley, will proceed with the erection of an addition to its plant, for which a general contract recently has been let to K. E. Parker, 519 California St., San Francisco, consisting of 2 buildings, estimated to cost $57,000.

Florida

JACKSONVILLE—Fire, July 25, destroyed a portion of the local plant of the Armour Fertilizer Works, Inc., Talleyrand Ave. and 8th St., comprising for the most part the sulphuric acid department, with loss estimated at $200,000, including equipment. It is purposed to rebuild. Headquarters of the company are at 209 West Jackson Blvd., Chicago, Ill.

SARASOTA—The Sarasota Cement Products Co., has work under way on a new plant on No. Central Ave., for the manufacture of cement tile. The company was organized recently by R. O. Thacker and J. F. Baumgartner, both of Sarasota.

Georgia

MILLEDGEVILLE—J. H. Ennis has tentative plans under consideration for the rebuilding of the portion of his fertilizer plant, destroyed by fire July 25, with total loss, including other buildings, reported at $50,000.

Illinois

LITCHFIELD—A 2-story foundry, 25x150 ft., will be constructed by the American Radiator Co., at its local plant, for the production of iron castings, estimated to cost $36,000. Headquarters of the company are at 816 So. Michigan Ave., Chicago, Ill.

Indiana

HUNTINGTON—The Commercial Asbestos Corp., recently formed with 100,000 shares of stock, no par value, has acquired the local plant constructed by the Rapid Rim Co., but never operated. The structure approximates 75,000 sq.ft. of floor area, and will be remodeled and equipped by the new owner for the manufacture of automobile brake linings, railway insulation products, and kindred specialties. E. W. Steinhart, Fort Wayne, Ind., and R. J. Evans, Wabash, Ind., head the new organization.

Iowa

CEDAR RAPIDS—Penick & Ford, Ltd., Whitney Bldg., New Orleans, La., manufacturer of sugar products, has construction in progress on a 4-story addition, 53x55 ft., for which a contract recently was awarded to the Foster Engineering Service Co., Indianapolis, Ind., and plans for the early installation of equipment.

Kentucky

CATLETTSBURG—The Sugar & Tree Syrup Co., 118 26th St., recently organized, will operate a local plant for the manufacture of table syrups, to develop a capacity of about 300 gal. per day. W. L. Maupin is president, and L. F. Martin, secretary.

Massachusetts

LYNN—The Lynn Gas & Electric Co., has awarded a general contract to the H. Koppers Co., Inc., Union Arcade Bldg., Pittsburgh, Pa., for the construction of its proposed coke oven plant and byproduct coke works, estimated to cost $600,000. An initial battery of 25 coke ovens with accessory equipment will be installed.

LEOMINSTER—The Viscoloid Co., manufacturer of celluloid products, has commenced foundations for a new 2-story addition, 15x113 ft., estimated to cost about $35,000, with equipment, for which a general contract has been let to Wiley & Foss, Fitchburg, Mass. Work is nearing completion on another building at the plant, costing approximately a like amount.

CAMBRIDGE—The Carter Ink Co., 239 1st St., East Cambridge, will begin superstructure work for a 3-story and basement addition, 80x115 ft., adjoining its present works. The Scully Co., Cambridge, is the general contractor. Densmore, LeClear & Robbins, Park Sq. Bldg., Boston, Mass., are architects.

Michigan

DETROIT—The Edmunds & Jones Corp., 4440 Lawton Ave., manufacturer of automobile headlights, will install an enameling department in its new 3-story addition, 90x167 ft., now in course of erection, with electric-operated ovens, air filtering and washing equipment, etc. The complete building will cost $400,000.

CALUMET—The Calumet & Hecla Co. has improvement work under way at its copper smelting plant, including the installation of a fuel pulverizing plant, 3 furnaces with rated capacity of 2,000,000 lbs. per month, and accessory equipment. The furnace units will replace several smaller ones.

Missouri

KANSAS CITY—The Kansas City Plating & Enameling Works, Inc., 1015 Central St., is considering tentative plans for a new 1-story and basement plant at Wyandotte and 17th Sts., estimated to cost $25,000. It is said that an architect will be selected to prepare plans at an early date.

New Jersey

GARFIELD—The Johnson Products Co., 665 Broad St., Newark, N. J., manufacturer of celluloid tubing and other celluloid products, will take bids at once for the erection of a new plant at Garfield, on site selected on Outwater Lane, estimated

to cost $80,000, with equipment. R. H. Simmons, 55 John St., New York, is architect. O. Johnson is president.

NEWARK — J. L. Armitage & Co., 245 Thomas St., manufacturers of varnish, etc., have filed plans for the erection of a 1-story addition to their plant.

New York

NEW YORK—The Pierce Petroleum Corp., 111 Broadway, formerly known as the Pierce Oil Co., has developed a fund of $3,325,000, for operations and expansions, etc. Plans are under way for the remodeling of the oil refining plant in the Mid-Continent field, to include the installation of considerable additional equipment. William H. Coverdale is chairman of the board.

Ohio

IRONTON—The Belfort Steel & Iron Co., Blanton, near Ironton, has preliminary sketches under way for the erection of 2 new Bessemer steel units at its plant, comprising rolling mill, rod mills, etc., with estimated cost in excess of $300,000. Arthur G. McKee & Co., 2422 Euclid Ave., Cleveland, are engineers.

LIMA—The Air Reduction Sales Co., 342 Madison Ave., New York, has awarded a general contract for superstructure work for its new local plant to Green & Sawyer, Citizens' Bldg., to be 2-story, 88 x 90 ft., for the manufacture of commercial oxygen, gases, etc. The plant will include a number of smaller buildings for carbide service, as well as 1-story power house, and will cost approximately $75,000. Another unit will be built later. Francisco & Jacobus, 511 5th Ave., New York, are architects and engineers.

Oklahoma

DUNCAN — The Mid-Continent Oil Leasing Co., Continental Bldg., Oklahoma City, Okla., has awarded contracts and will commence the construction of a large gas compressor plant on local site, to be used in connection with gasoline production. It will cost in excess of $100,000.

Pennsylvania

POINT MARION—Fire, July 28, destroyed the plant of the Quertinmont Glass Co., Nilan, near Point Marion, manufacturer of window glass, with loss estimated at $100,000, including equipment. It is said that plans are under advisement for rebuilding.

CONSHOHOCKEN—The Quaker Oil Products Co. will establish a new oil-compounding, storage and distributing plant on Elm St. The present works will be removed to the new location.

GLENFIELD—The Consolidated Paper Co., Monroe, Mich., is reported to be considering the erection of a new mill in this vicinity, comprising a number of 1-story units. Actual construction may be deferred for several months. An architect and engineer have not as yet been selected.

BRISTOL — The Megargee Paper Co., Modena, Pa., has work in progress on a new local mill for the production of finished paper specialties, and plans for the early installation of machinery. It is expected to cost in excess of $125,000.

WASHINGTON — The Pittsburgh Sheet Glass Co., recently starting operations at a new local mill, is reported to have plans under advisement for early enlargements for considerable increase in capacity, with estimated cost placed in excess of $250,000. Walter A. Jones is president.

CONSHOHOCKEN — Work has been commenced on a 1-story foundry at the plant of the Hale Fire Pump Co., for the manufacture of brass and other metal castings. The company purchased the local foundry of the Scotia Brass Co., a number of months ago, and is now operating at this plant.

Utah

SALT LAKE CITY—The Utah-Idaho Sugar Co. is reported to have tentative plans under advisement for the construction of a new beet sugar mill in Southern Alberta, Canada, consisting of a main refinery unit, power house, machine shop, etc., estimated to cost more than $300,000, with equipment. Farmers in the vicinity of Cardston, Alberta, have been approached with a proposition to raise beets for the proposed mill.

Washington

SEATTLE — The Pacific Nitrogen Corp. has awarded a general contract to H. D. Stewart, American Bank Bldg., for the construction of the first unit of its proposed local plant on Northlake Ave., estimated to cost $85,000. Other buildings will be erected at a later date.

CENTRALIA — The Concrete Pipe Co., Summa and Railway Sts., manufacturer of cement and concrete products, has tentative plans for the erection of a 1-story addition.

SPOKANE—The St. Louis Brass & Iron Works, Inc., recently organized, has commenced operations at its new local plant, and purposes to develop maximum capacity for bronze and iron castings, with initial daily output of 7,500 tons and 6,500 tons, respectively. It is also proposed to manufacture brass and aluminum castings. A. E. Binder is president and general manager.

SEATTLE—The Standard Oil Co., Alaska Bldg., has awarded a general contract to the Rounds-Clist Co., Walker Bldg., for the erection of its proposed oil storage and distributing plant at Northlake Ave. and North 34th St., to cost in excess of $90,000, with equipment.

West Virginia

FAIRMONT—New interests have acquired control of the Columbia Glass Co., manufacturer of pressed and blown ware, and will take possession at an early date. Preliminary plans are under consideration for extensions and improvements. Clarence D. Robinson, head of the Robinson Coal Co., and president of the local Chamber of Commerce, heads the new organization.

New Companies

SOUTHERN ART TILE Co., Miami, Fla.; ceramic tile products; $10,000. Incorporators: T. H. Codrick and J. F. Muir, both of Miami.

TEXAS PAINT Co., Corsicana, Tex.; paints, varnishes, etc.; $28,000. Incorporators: J. A. Blackshear and W. F. Priddy, both of Corsicana.

JERSEY STICK GLUE Co., 86 Park Pl., Newark, N. J.; glue and other adhesives; filed notice of organization, with Louis V. Silver, 119 So. Harrison St., East Orange, N. J., as head.

RING CHEMICAL Co., Auburn, N. Y.; chemicals and chemical byproducts; $25,000. Incorporators: J. F., and J. E. Ring; and M. F. O'Leary. Representative: C. T. Whelan, Auburn.

ORA RUBBER PRODUCTS Co., Denver, Colo.; rubber goods; $125,000. Incorporators: W. S. Smith, and C. M. Bennett. Representative: R. Robinson, 902 Patterson Bldg., Denver.

ALLOY TOOL STEEL Co., Boston, Mass.; alloy steels; $250,000. Andrew M. McRae is president; and Wesley L. Minor, 16 Summit Ave., Wollaston, Mass., treasurer and representative.

KANSAS PORTLAND CEMENT Co., Kansas City, Mo.; to operate a cement mill; $500,000. H. Struckmann is president; and Baxter D. McClain, secretary. The company will be affiliated with the International Cement Corp., 342 Madison Ave., New York, of which H. Struckmann also is president.

SILICA PLASTER Co., Cleveland, O.; plasters, cements, etc.; $50,000 and 1,500 shares of stock, no par value. Incorporators: M. D. Madden, and Fletcher R. Andrews, both of Cleveland.

SUPERIOR FLUORSPAR CORP., care of the Colonial Charter Co., Ford Bldg., Wilmington, Del., representative; to operate fluorspar properties and reduction plants for commercial production; $300,000.

CITIZENS' COTTON OIL Co., Anderson, S. C.; cotton oil products; $30,000. Incorporators: W. P., and R. L. Nimmons, both of Anderson. The first noted will be president.

ERIE PETROLEUM Co., Denver, Colo.; refined petroleum products; $10,000,000. Incorporators: A. M. Holl, R. Sterns, and F. Sanborn. Representative: Lewis & Grant, First National Bank Bldg., Denver.

SOUTHERN RUBBER PRODUCTS Co., Little Rock, Ark.; rubber goods; $25,000. E. J. Brown, 2601 James St., Little Rock, is president; and Harry Daniels, secretary.

MAMOLITH CARBON PAINT Co., New York, N. Y.; special paint products; 200 shares of stock, no par value. Incorporators: C. A. Benton, A. D. Joyce, and J. P. Watner. Representative: C. H. Kolf, attorney, Cleveland, O.

O-SO-WHITE PRODUCTS Co., Grand Rapids, Mich.; soaps, washing powders, etc.; $30,000. Incorporators: William J. Maloney and Charles Donovan, 953 Ionia Ave., S. W., Grand Rapids.

STANDARD PORTLAND CEMENT Co., Moundsville, W. Va.; cement products; $150,000. Incorporators: S. B. Wilson and D. B. Evans, both of Moundsville.

OZARK LEATHERCRAFT Co., Carthage, Mo.; leather products; capital not stated. Incorporators: F. M. Clayton, Robert F. Redmond, and B. F. McCoy, 716 Lincoln St., Carthage.

HALLOWEEN CHEMICAL CORP., Cincinnati, O.; chemicals and chemical byproducts; 10,000 shares of stock, no par value. Incorporators: Frank X. Owens, Ray Haller, and Edward F. Peters, all of Cincinnati.

IRON SPONGE PRODUCTS Co., 105 No. Clark St., Chicago, Ill.; oxide fertilizers, etc.; $5,000. Incorporators: Paul Metzgar, Richmond Schnellenberger and John D. Farrell.

FARMERS' COTTON OIL Co., Texarkana, Tex.; cotton oil products; $100,000. Incorporators: W. T. Murphy, C. L. Cabe and D. C. Harrington, all of Texarkana.

PREPARED LIME & MORTAR Co., 351 Doremus Ave., Newark, N. J.; lime, mortar and kindred products; $25,000. Incorporators: Murray De Leeuw, William K. Sheehan and John C. Fallon.

GILBRALTAR BRONZE Co., Cincinnati, O.; bronze, brass and kindred products; 1,000 shares of stock no par value. Incorporators: C. L. Shafer, Robert Black and John P. Errett, all of Cincinnati.

LIBERTY PETROLEUM Co., care of the Corporation Trust Co. of America, du Pont Bldg., Wilmington, Del., representative; refined petroleum products; $1,000,000.

H. J. JUSTIN & SONS, INC., Nocona, Tex.; leather products; $100,000. Incorporators: J. S. and W. E. Justin, both of Nocona.

PROOFING LABORATORIES, INC., New York; chemicals and chemical byproducts; 90 shares of stock, no par value. Incorporators: E. C. Dreyer, G. H. Kerner and J. E. Malino. Representative: Gilbert & Gilbert, 43 Exchange Pl., New York.

Industrial Notes

WARREN WEBSTER AND Co. of Camden, N. J., announce the opening of two new branches at Butte, Montana and Albany, N. Y. The Butte office is located at 223 No. Main Street and is in charge of T. L. Sullivan, formerly of the Anaconda Copper Mining Co. and more recently with the Montana State Engineering Department. This office will have charge of all business in the state. The Albany office, at 28 So. Pearl Street, is in charge of Horace A. Bond, for many years service engineer with the New York city branch.

New Publications

RESEARCHES ON THE THEORY OF FINE GRINDING. Part I. By Charles E. Blyth, Geoffrey Martin, and Harold Tongue. Pamphlet No. 4 of the British Portland Cement Research Association, 6 Lloyds Avenue, London, E. C. 3, England.

THE COLLOIDAL MECHANISM AND PHYSICAL PROPERTIES OF GLUE. By Frank J. Crupi, Chemist in the Research Laboratory, Herman Behr and Co., Inc., 31-63 Tiffany Place, Brooklyn, N. Y. Copies will be distributed to anyone interested in work of this nature.

NEW BUREAU OF STANDARDS PUBLICATIONS: Circ. No. 100. Nickel and Its Alloys. (Second Edition). Price 40 cents; Circ. No. 101. Physical Properties of Materials. Strength and Related Properties of Metals and Wood. (Second edition). Price 40 cents; Scien. Paper No. 488. Thermal Expansion of Molybdenum. By Peter Hidnert and W. B. Gero. Price 10 cents; Tech. Paper No. 257. Development of a Method for Measurement of Internal Stress in Brass Tubing. By Robert J. Anderson and Everett G. Fahlman. Price 5 cents. All copies can be purchased through the Superintendent of Documents, Government Printing Office, Washington, D. C.

NEW U. S. GEOLOGICAL SURVEY PUBLICATIONS: I: 3. Bauxite and Aluminum in 1923. By James M. Hill (Mineral Resources of the U. S., 1923, Part I) published July 21, 1924; II: 3. Strontium in 1923. By George W. Stose (Mineral Resources of the U. S., 1923, Part II) published July 19, 1924; II: 4 Fluorspar and Cryolite in 1923. By Hubert W. Davis (Mineral Resources of the U. S., 1923, Part II) published July 25, 1924; II: 52. Petroleum in 1922. By G. B. Richardson (Mineral Resources of the U. S., 1922, Part II) published July 15, 1924.

IMPERIAL MINERAL RESOURCES BUREAU PUBLICATION: Statistical Summary (Production, Imports and Exports) 1920-1922. Price 8s. net. Copies can be obtained from His Majesty's Stationery office, Imperial House, Kingsway, London, W. C. 2, England.